

**CENTRAL UNIVERSITY OF KARNATAKA  
KALABURAGI**

**SCHOOL OF COMPUTER SCIENCES**



**COURSE STRUCTURE AND SYLLABUS**

**Bachelor of Technology (B. Tech)**

**COMPUTER SCIENCE & ENGINEERING (AI & ML)**

**(Effective from the academic year 2024 –25)**

Department of Computer Science,  
School of Computer Sciences,  
Central University of Karnataka  
Kalaburagi-585367

**CENTRAL UNIVERSITY OF  
KARNATAKA**

*(Established by an Act of the Parliament in 2009)*  
Kadaganchi, Kalaburagi – 585367, INDIA



**Department of Computer Science**  
**School of Computer Science**  
Kadaganchi, Aland Road,  
Kalaburagi District– 585367

## **Bachelor of Technology (Computer Science)**

### **ABOUT PROGRAM**

The B.Tech. Computer Science and Engineering, with specialization of Artificial Intelligence and Machine Learning program launching in 2024 provides a comprehensive blend of theoretical knowledge and practical skills in cutting-edge technologies. Through a diverse curriculum, students gain expertise in computer science fundamentals, artificial intelligence, machine learning, deep learning, and natural language processing, alongside specialized training in AI and ML. Hands-on laboratory sessions using advanced computational software facilitate practical exploration of AI, ML, and data analytics concepts. Elective courses in AI and ML allow students to shape their education to their career aspirations. Opportunities for research projects foster innovation and creativity in AI and ML technologies. Graduates are prepared for diverse roles such as AI specialists, software engineers, and data scientists. The program also serves as a solid foundation for further studies in top institutions worldwide.

### **ELIGIBILITY FOR ADMISSION**

Students who have passed PU/Plus Two examination with 50% marks (45% for OBC {NON CREAMY LAYER}, SC, ST, PWD and Kashmiri Migrant and nonmigrant pandits ) and having studied Physics, Chemistry and Mathematics (Note: 50% average score (45% for OBC {NON CREAMY LAYER}, SC, ST, PWD and Kashmiri Migrant and nonmigrant pandits ) is mandatory in Physics, Chemistry and Mathematics). The merit list shall be prepared based on the students CUET - UG 2024 score (conducted by NTA) from domain Subjects (Physics, Chemistry and Mathematics). 50% of the seats will be filled on the basis of performance in JEE– Main Exam (2024), the national level test conducted by the IITs for admission to all their UG programmes. Remaining 50% seats will be filled on the basis of merit in the Common University Entrance Test (CUET) 2024 to be conducted by NTA

### **DURATION OF COURSE**

4 years (8 Semester)

### **MEDIUM OF INSTRUCTION**

The medium of instruction shall be English.

### **PASSING AND CLASSIFICATION**

The minimum marks for passing and classification for the award of the BTech in Computer Science and Engineering (AI and ML) degree shall be as per the existing norms of other UG degree courses of Central University of Karnataka, Kalaburagi.

## **OTHER PROVISIONS**

All the other provisions relating to attendance, reappearance in examinations, repeat and saving clauses, removal of difficulties, etc., shall be as per the existing norms of other UG degree courses of Central University of Karnataka, Kalaburagi.

### **Vision Statement:**

To groom the students technically competent and skilled intellectual professionals to address the challenges in current computing arena arising in Software Industry, Academia and Research & Development laboratories.

### **Mission Statements:**

1. Excellence in Teaching and Research.
2. Assist in all e-Governance Initiatives in the University.
3. Interaction with Industries and Research organizations.

**CENTRAL UNIVERSITY OF KARNATAKA, KALABURAGI**  
**PROPOSED MODEL CURRICULUM COMPONENTS**  
**Comparison of suggested breakup of AICTE and CUK Curriculum**

Credit Distribution for B. Tech. Computer Science and Engineering

(AI & ML) (2024-2025 batch and onwards)

| Category of Courses Proposed              | Credits by CUK | AICTE Suggested Credits | Comparison |
|-------------------------------------------|----------------|-------------------------|------------|
| Humanities & Social Science Courses (HSC) | 06             | 10                      | -4         |
| Basic Science Courses (BSC)               | 19             | 16                      | 3          |
| Engineering Science Courses(ESC)          | 07             | 08                      | -1         |
| Discipline Specific Courses (DSC)         | 84             | 71                      | 13         |
| Professional Elective Courses (PEC)       | 16             | 16                      | 0          |
| Open Elective Courses (OEC)               | 06             | 06                      | 0          |
| Employment Enhancement Courses (EEC)      | 30             | 38                      | -8         |
| <b>Total</b>                              | <b>168</b>     | <b>165</b>              | <b>3</b>   |

- Environmental science & Indian constitution non-credit course according to AICTE.

## GENERAL COURSE STRUCTURE & THEME

| Semester     | HSC      | BSC       | ESC      | DSC       | PEC       | OEC      | EEC       | Total      |
|--------------|----------|-----------|----------|-----------|-----------|----------|-----------|------------|
| SEM I        | 3        | 6         | 4        | 6         | -         | -        | -         | 19         |
| SEM II       | 1        | 10        | 3        | 6         | -         | -        | -         | 20         |
| SEM III      | 2        | 3         | -        | 18        | -         | -        | -         | 23         |
| SEM IV       | -        | -         | -        | 20        | -         | -        | -         | 20         |
| SEM V        | -        | -         | -        | 14        | 4         | 3        | 3         | 24         |
| SEM VI       | -        | -         | -        | 16        | 4         | -        | 3         | 23         |
| SEM VII      | -        | -         | -        | 4         | 4         | 3        | 12        | 23         |
| SEM VIII     | -        | -         | -        | -         | 4         | -        | 12        | 16         |
| <b>Total</b> | <b>6</b> | <b>19</b> | <b>7</b> | <b>84</b> | <b>16</b> | <b>6</b> | <b>30</b> | <b>168</b> |

### ➤ Category-wise Courses

#### HUMANITIES & SOCIAL SCIENCES COURSES [HSC]

1. Number of Humanities & Social Science Courses: 3
2. Credits: 6

| Sl. No.              | Course Code | Course Title           | Mode |   |   | Total Credits | Semester     |
|----------------------|-------------|------------------------|------|---|---|---------------|--------------|
|                      |             |                        | L    | T | P |               |              |
| 1                    | UAICA10100  | Communication Skills   | 2    | 0 | 2 | 3             | Semester I   |
| 2                    | UAIPA20100  | Design Thinking        | 0    | 0 | 2 | 1             | Semester II  |
| 3                    | UAICA30200  | Universal Human Values | 2    | 0 | 0 | 2             | Semester III |
| <b>Total Credits</b> |             |                        |      |   |   | <b>6</b>      |              |

#### BASIC SCIENCE COURSES [BSC]

1. Number of Basic Science Courses: 6
2. Credits: 19

| Sl. No.              | Course Code | Course Title                     | Mode |   |   | Total Credits | Semester     |
|----------------------|-------------|----------------------------------|------|---|---|---------------|--------------|
|                      |             |                                  | L    | T | P |               |              |
| 1                    | UAITC20103  | Engineering Physics              | 3    | 0 | 0 | 3             | Semester II  |
| 2                    | UAITC10101  | Engineering Mathematics I        | 3    | 0 | 0 | 3             | Semester I   |
| 3                    | UAITC10100  | Engineering Chemistry            | 3    | 0 | 0 | 3             | Semester I   |
| 4                    | UAITC20104  | Engineering Mathematics II       | 3    | 0 | 0 | 3             | Semester II  |
| 5                    | UAITC20106  | Discrete Mathematical Structures | 3    | 1 | 0 | 4             | Semester II  |
| 6                    | UAITC30200  | Mathematical Concepts for AI     | 3    | 0 | 0 | 3             | Semester III |
| <b>Total Credits</b> |             |                                  |      |   |   | <b>19</b>     |              |

**ENGINEERING SCIENCE COURSES [ESC]**

1. Number of Engineering Science Courses: 3
2. Credits: 7

| Sl. No.       | Course Code | Course Title                        | Mode |   |   | Total Credits | Semester    |
|---------------|-------------|-------------------------------------|------|---|---|---------------|-------------|
|               |             |                                     | L    | T | P |               |             |
| 1             | UAICC10100  | Basic Electrical Engineering        | 2    | 0 | 2 | 3             | Semester I  |
| 2             | UAIPC10100  | Computer Aided Engineering Graphics | 0    | 0 | 2 | 1             | Semester I  |
| 3             | UAICC20101  | Basic Electronics                   | 2    | 0 | 2 | 3             | Semester II |
| Total Credits |             |                                     |      |   |   | 7             |             |

**DISCIPLINE SPECIFIC COURSES [DSC]**

1. Number of Discipline Specific Courses: 24
2. Credits: 84

| Sl. No. | Course Code | Course Title                           | Mode |   |   | Total Credits | Semester     |
|---------|-------------|----------------------------------------|------|---|---|---------------|--------------|
|         |             |                                        | L    | T | P |               |              |
| 1       | UAITC10102  | Programming for Problem solving        | 3    | 1 | 0 | 4             | Semester I   |
| 2       | UAIPC10101  | Lab on Programming for Problem solving | 0    | 0 | 4 | 2             | Semester I   |
| 3       | UAITC20105  | Object-Oriented Programming using Java | 3    | 1 | 0 | 4             | Semester II  |
| 4       | UAIPC20102  | Lab on OOPs using Java                 | 0    | 0 | 4 | 2             | Semester II  |
| 5       | UAITC30201  | Computer Organization and Architecture | 3    | 1 | 0 | 4             | Semester III |
| 6       | UAITC30202  | Data Structures                        | 3    | 1 | 0 | 4             | Semester III |
| 7       | UAITC30203  | Artificial Intelligence                | 3    | 1 | 0 | 4             | Semester III |
| 8       | UAICC30200  | Python Programming                     | 3    | 0 | 2 | 4             | Semester III |
| 9       | UAIPC30200  | Lab on Data Structures                 | 0    | 0 | 4 | 2             | Semester III |
| 10      | UAICC40201  | Introduction to Machine Learning       | 3    | 0 | 2 | 4             | Semester IV  |
| 11      | UAITC40204  | Design & Analysis of Algorithms (DAA)  | 3    | 1 | 0 | 4             | Semester IV  |
| 12      | UAITC40205  | Software Engineering Principles        | 3    | 0 | 0 | 3             | Semester IV  |
| 13      | UAICC40202  | Computer Networks                      | 3    | 0 | 2 | 4             | Semester IV  |
| 14      | UAITC40206  | Operating Systems                      | 3    | 0 | 0 | 3             | Semester IV  |
| 15      | UAIPC40201  | Lab on DAA                             | 0    | 0 | 4 | 2             | Semester IV  |
| 16      | UAITC50300  | Deep Learning                          | 3    | 1 | 0 | 4             | Semester V   |
| 17      | UAICC50300  | Database Management Systems            | 3    | 0 | 2 | 4             | Semester V   |
| 18      | UAITC50301  | Theory of Computation                  | 3    | 1 | 0 | 4             | Semester V   |
| 19      | UAIPC50300  | Lab on Deep Learning                   | 0    | 0 | 4 | 2             | Semester V   |
| 20      | UAICC60301  | Advanced Machine Learning              | 3    | 0 | 2 | 4             | Semester VI  |
| 21      | UAICC60302  | Data & Visual Analytics in AI          | 3    | 0 | 2 | 4             | Semester VI  |

|                      |            |                                            |   |   |   |           |              |
|----------------------|------------|--------------------------------------------|---|---|---|-----------|--------------|
| 22                   | UAITC60302 | Optimization Technique in Machine Learning | 3 | 1 | 0 | 4         | Semester VI  |
| 23                   | UAICC60303 | Natural Language Processing                | 3 | 0 | 2 | 4         | Semester VI  |
| 24                   | UAITC70400 | Soft Computing                             | 3 | 0 | 2 | 4         | Semester VII |
| <b>Total Credits</b> |            |                                            |   |   |   | <b>84</b> |              |

#### PROFESSIONAL ELECTIVE COURSES (PEC)

1. Number of Professional Elective Courses: 4
2. Credits: 16

| Sl. No.              | Course Code | Course Title              | Mode |   |   | Total Credits | Semester      |
|----------------------|-------------|---------------------------|------|---|---|---------------|---------------|
|                      |             |                           | L    | T | P |               |               |
| 1                    | UAITL50XXX  | Professional Elective-I   | 3    | 1 | 0 | 4             | Semester V    |
| 2                    | UAITL60XXX  | Professional Elective-II  | 3    | 1 | 0 | 4             | Semester VI   |
| 3                    | UAITL70XXX  | Professional Elective-III | 3    | 1 | 0 | 4             | Semester VII  |
| 4                    | UAITL80XXX  | Professional Elective IV  | 3    | 1 | 0 | 4             | Semester VIII |
| <b>Total Credits</b> |             |                           |      |   |   | <b>16</b>     |               |

#### OPEN ELECTIVE COURSES (OEC)

1. Number of Open Elective Courses: 2
2. Credits: 6

| Sl. No.              | Course Code | Course Title     | Mode |   |   | Total Credits | Semester     |
|----------------------|-------------|------------------|------|---|---|---------------|--------------|
|                      |             |                  | L    | T | P |               |              |
| 1                    | UAICO50XXX  | Open Elective I  | 2    | 0 | 2 | 3             | Semester V   |
| 2                    | UAICO70XXX  | Open Elective II | 2    | 0 | 2 | 3             | Semester VII |
| <b>Total Credits</b> |             |                  |      |   |   | <b>6</b>      |              |

#### EMPLOYMENT ENHANCEMENT COURSES (EEC)

1. Number of Employment Enhancement Courses: 6
2. Credits: 30

| Sl. No.              | Course Code | Course Title                   | Mode |   |   | Total Credits | Semester      |
|----------------------|-------------|--------------------------------|------|---|---|---------------|---------------|
|                      |             |                                | L    | T | P |               |               |
| 1                    | UAIPR50300  | Mini project                   | -    | - | - | 3             | Semester V    |
| 2                    | UAIPR60301  | Mini project                   | -    | - | - | 3             | Semester VI   |
| 3                    | UAIPR70400  | Technical Seminar              | -    | - | - | 2             | Semester VII  |
| 4                    | UAIPR70400  | Industrial/Research Internship | -    | - | - | 6             | Semester VII  |
| 5                    | UAIPR70401  | Capstone Project Phase I       | -    | - | - | 4             | Semester VII  |
| 6                    | UAIPR80402  | Capstone Project Phase II      | -    | - | - | 12            | Semester VIII |
| <b>Total Credits</b> |             |                                |      |   |   | <b>30</b>     |               |

## COURSE STRUCTURE - FIRST YEAR B. TECH

### COMPUTER SCIENCE & ENGINEERING (AI & ML)

**Name of the School:** Computer Sciences

**Name of the Department:** Computer Science

**Programme Code:** AI

#### I SEMESTER

| Sr. No       | Course Type                         | Course code | Course Title                           | Mode      |          |           | Credits   |
|--------------|-------------------------------------|-------------|----------------------------------------|-----------|----------|-----------|-----------|
|              |                                     |             |                                        | L         | T        | P         |           |
| 1            | Basic Science Courses               | UAITC11100  | Engineering Chemistry                  | 3         | 0        | 0         | 3         |
| 2            | Basic Science Courses               | UAITC10101  | Engineering Mathematics I              | 3         | 0        | 0         | 3         |
| 3            | Discipline Specific Courses         | UAITC10102  | Programming for Problem solving        | 3         | 1        | 0         | 4         |
| 4            | Engineering Science Courses         | UAICC10100  | Basic Electrical Engineering           | 2         | 0        | 2         | 3         |
| 5            | Humanities & Social Science Courses | UAICA10100  | Communication Skills                   | 2         | 0        | 2         | 3         |
| 6            | Audit Course                        | UAITA11100  | Environmental Science                  | 2         | 0        | 0         | 0         |
| 7            | Engineering Science Courses         | UAIPC10100  | Computer Aided Engineering Graphics    | 0         | 0        | 2         | 1         |
| 8            | Discipline Specific Courses         | UAIPC10101  | Lab on Programming for Problem solving | 0         | 0        | 4         | 2         |
| <b>Total</b> |                                     |             |                                        | <b>15</b> | <b>1</b> | <b>10</b> | <b>19</b> |

#### II SEMESTER

| Sr. No       | Course Type                        | Course code | Course Title                           | Mode      |          |          | Credits   |
|--------------|------------------------------------|-------------|----------------------------------------|-----------|----------|----------|-----------|
|              |                                    |             |                                        | L         | T        | P        |           |
| 1            | Basic Science Course               | UAITC21103  | Engineering Physics                    | 3         | 0        | 0        | 3         |
| 2            | Basic Science Course               | UAITC20104  | Engineering Mathematics II             | 3         | 0        | 0        | 3         |
| 3            | Discipline Specific Course         | UAITC20105  | Object-Oriented Programming using Java | 3         | 1        | 0        | 4         |
| 4            | Engineering Science Course         | UAICC20101  | Basic Electronics                      | 2         | 0        | 2        | 3         |
| 5            | Basic Science Course               | UAITC20106  | Discrete Mathematical Structures       | 3         | 1        | 0        | 4         |
| 6            | Humanities & Social Science Course | UAIPA20100  | Design Thinking                        | 0         | 0        | 2        | 1         |
| 7            | Discipline Specific Course         | UAIPC20102  | Lab on OOPs using Java                 | 0         | 0        | 4        | 2         |
| <b>Total</b> |                                    |             |                                        | <b>14</b> | <b>2</b> | <b>6</b> | <b>20</b> |

**Note:** HSC-Humanities & Social Science Course, BSC-Basic Science Course, ESC-Engineering Science Course, DSC-Discipline Specific Course, AC- Audit Course, OEC-Open Elective Courses.

- Audit Courses are mandatory non-credit courses.

\*Course Type: Major, Minor, MDC, AEC, SEC, VAC etc.

**COURSE STRUCTURE – SECOND YEAR B. TECH**  
**COMPUTER SCIENCE & ENGINEERING (AI & ML)**

**Name of the School:** Computer Sciences

**Name of the Department:** Computer Science

**Programme Code:** AI

| III SEMESTER |                                    |             |                                        |           |          |          |           |
|--------------|------------------------------------|-------------|----------------------------------------|-----------|----------|----------|-----------|
| Sr. No       | Course Type                        | Course code | Course Title                           | Mode      |          |          | Credits   |
|              |                                    |             |                                        | L         | T        | P        |           |
| 1            | Basic Science Courses              | UAITC30200  | Mathematical Concepts for AI           | 3         | 0        | 0        | 3         |
| 2            | Discipline Specific Course         | UAITC30201  | Computer Organization and Architecture | 3         | 1        | 0        | 4         |
| 3            | Discipline Specific Course         | UAITC30202  | Data Structures                        | 3         | 1        | 0        | 4         |
| 4            | Discipline Specific Course         | UAITC30203  | Artificial Intelligence                | 3         | 1        | 0        | 4         |
| 5            | Discipline Specific Course         | UAICC30200  | Python Programming                     | 3         | 0        | 2        | 4         |
| 6            | Humanities & Social Science Course | UAICA30200  | Universal Human Values                 | 2         | 0        | 0        | 2         |
| 7            | Discipline Specific Course         | UAIPC30200  | Lab on Data Structures                 | 0         | 0        | 4        | 2         |
| <b>Total</b> |                                    |             |                                        | <b>17</b> | <b>3</b> | <b>6</b> | <b>23</b> |

| IV SEMESTER  |                             |             |                                       |           |          |          |           |
|--------------|-----------------------------|-------------|---------------------------------------|-----------|----------|----------|-----------|
| Sr. No       | Course Type                 | Course code | Course Title                          | Mode      |          |          | Credits   |
|              |                             |             |                                       | L         | T        | P        |           |
| 1            | Discipline Specific Courses | UAICC40201  | Introduction to Machine Learning      | 3         | 0        | 2        | 4         |
| 2            | Discipline Specific Course  | UAITC40204  | Design & Analysis of Algorithms (DAA) | 3         | 1        | 0        | 4         |
| 3            | Discipline Specific Course  | UAITC40205  | Software Engineering Principles       | 3         | 0        | 0        | 3         |
| 4            | Discipline Specific Course  | UAICC40202  | Computer Networks                     | 3         | 0        | 2        | 4         |
| 5            | Discipline Specific Course  | UAITC40206  | Operating Systems                     | 3         | 0        | 0        | 3         |
| 6            | Audit Course                | UAITA40101  | Indian Constitution                   | 2         | 0        | 0        | 0         |
| 7            | Discipline Specific Course  | UAIPC40201  | Lab on DAA                            | 0         | 0        | 4        | 2         |
| <b>Total</b> |                             |             |                                       | <b>17</b> | <b>1</b> | <b>8</b> | <b>20</b> |

\*Course Type: Major, Minor, MDC, AEC, SEC, VAC etc.

**COURSE STRUCTURE - THIRD YEAR B. TECH**  
**COMPUTER SCIENCE & ENGINEERING (AI & ML)**

**Name of the School:** Computer Sciences

**Name of the Department:** Computer Science

**Programme Code:** AI

| V SEMESTER   |                               |             |                                       |           |          |          |           |
|--------------|-------------------------------|-------------|---------------------------------------|-----------|----------|----------|-----------|
| Sr. No       | Course Type                   | Course code | Course Title                          | Mode      |          |          | Credits   |
|              |                               |             |                                       | L         | T        | P        |           |
| 1            | Discipline Specific Course    | UAITC50300  | Deep Learning                         | 3         | 1        | 0        | 4         |
| 2            | Discipline Specific Course    | UAICC50300  | Database Management Systems           | 3         | 0        | 2        | 4         |
| 3            | Discipline Specific Course    | UAITC50301  | Theory of Computation                 | 3         | 1        | 0        | 4         |
| 4            | Professional Elective Course  | UAITL50400  | Statistical Thinking for Data Science | 3         | 1        | 0        | 4         |
|              |                               | UAITL50401  | Big Data Analytics                    |           |          |          |           |
|              |                               | UAITL50402  | Image and Video Processing            |           |          |          |           |
|              |                               | UAITL50403  | Bioinformatics                        |           |          |          |           |
|              |                               | UAITL50404  | Network Security and Cryptography     |           |          |          |           |
| 5            | Open Elective Course          | UAICO50400  | Machine Learning with Python          | 2         | 0        | 2        | 3         |
|              |                               | UAICO50401  | IOT                                   |           |          |          |           |
| 6            | Discipline Specific Course    | UAIPC50300  | Lab on Deep Learning                  | 0         | 0        | 4        | 2         |
| 7            | Employment Enhancement Course | UAIPR50300  | Mini project                          | -         | -        | -        | 3         |
| <b>Total</b> |                               |             |                                       | <b>14</b> | <b>3</b> | <b>8</b> | <b>24</b> |

| VI SEMESTER  |                               |             |                                   |           |          |          |           |
|--------------|-------------------------------|-------------|-----------------------------------|-----------|----------|----------|-----------|
| Sr. No       | Course Type                   | Course code | Course Title                      | Mode      |          |          | Credits   |
|              |                               |             |                                   | L         | T        | P        |           |
| 1            | Discipline Specific Courses   | UAICC60301  | Advanced Machine Learning         | 3         | 0        | 2        | 4         |
| 2            | Discipline Specific Courses   | UAICC60302  | Data & Visual Analytics in AI     | 3         | 0        | 2        | 4         |
| 3            | Discipline Specific Courses   | UAITC60302  | IOT                               | 3         | 1        | 0        | 4         |
| 4            | Discipline Specific Courses   | UAICC60303  | Natural Language Processing       | 3         | 0        | 2        | 4         |
| 5            | Professional Elective Course  | UAITL60405  | Machine Learning for Data Science | 3         | 1        | 0        | 4         |
|              |                               | UAITL60406  | Predictive Analytics              |           |          |          |           |
|              |                               | UAITL60407  | Deep Learning for Computer Vision |           |          |          |           |
|              |                               | UAITL60408  | Genome Sequencing                 |           |          |          |           |
|              |                               | UAITL60409  | Security Analytics                |           |          |          |           |
| 6            | Employment Enhancement Course | UAIPR60301  | Mini project                      | -         | -        | -        | 3         |
| <b>Total</b> |                               |             |                                   | <b>15</b> | <b>2</b> | <b>6</b> | <b>23</b> |

\*Course Type: Major, Minor, MDC, AEC, SEC, VAC etc

## COURSE STRUCTURE - FOURTH YEAR B. TECH COMPUTER SCIENCE & ENGINEERING (AI & ML)

**Name of the School:** Computer Sciences

**Name of the Department:** Computer Science

**Programme Code:** AI

### VII SEMESTER

| Sr. No       | Course Type                   | Course code | Course Title                             | Mode     |          |          | Credits   |
|--------------|-------------------------------|-------------|------------------------------------------|----------|----------|----------|-----------|
|              |                               |             |                                          | L        | T        | P        |           |
| 1            | Discipline Specific Courses   | UAITC70400  | Soft Computing                           | 3        | 0        | 2        | 4         |
| 2            | Professional Elective Course  | UAITL70410  | Reinforcement Learning                   | 3        | 1        | 0        | 4         |
|              |                               | UAITL70411  | Pattern Recognition & Visual Recognition |          |          |          |           |
|              |                               | UAITL70412  | Autonomous Systems                       |          |          |          |           |
|              |                               | UAITL70413  | Algorithms for DNA Sequencing            |          |          |          |           |
|              |                               | UAITL70414  | Privacy and Data Protection              |          |          |          |           |
| 3            | Open Elective Course          | UAICO70402  | AI for Everyone                          | 2        | 0        | 2        | 3         |
|              |                               | UAICO70403  | Robotics                                 |          |          |          |           |
| 4            | Employment Enhancement Course | UAIPR70400  | Technical Seminar                        | -        | -        | -        | 2         |
| 5            | Employment Enhancement Course | UAIPR70400  | Industrial/Research Internship           | -        | -        | -        | 6         |
| 6            | Employment Enhancement Course | UAIPR70401  | Capstone Project Phase I                 | -        | -        | -        | 4         |
| <b>Total</b> |                               |             |                                          | <b>8</b> | <b>1</b> | <b>9</b> | <b>23</b> |

Minimum 8 weeks of Industrial/Research Internship has to be completed during vacations in either offline or virtual mode.

### VIII SEMESTER

| Sr. No       | Course Type                   | Course code | Course Title                    | Mode     |          |          | Credits   |
|--------------|-------------------------------|-------------|---------------------------------|----------|----------|----------|-----------|
|              |                               |             |                                 | L        | T        | P        |           |
| 1            | Professional Elective Course  | UAITL80415  | Solve Business Problems with AI | 3        | 1        | 0        | 4         |
|              |                               | UAITL80416  | AI in Gaming                    |          |          |          |           |
|              |                               | UAITL80417  | AI in Healthcare                |          |          |          |           |
|              |                               | UAITL80418  | AI in Finance                   |          |          |          |           |
| 2            | Employment Enhancement Course | UAIPR80402  | Capstone Project Phase II       | -        | -        | -        | 12        |
| <b>Total</b> |                               |             |                                 | <b>3</b> | <b>1</b> | <b>0</b> | <b>16</b> |

Professional Elective IV may be taught in online mode for the students doing Capstone Project Phase II outside the CUK, However, the Evaluation should be done in offline mode only.

\*Course Type: Major, Minor, MDC, AEC, SEC, VAC etc

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|                                                                                                                      |                                                                                                                                   | <b>B. Tech Course<br/>Structure &amp; Syllabus</b> |
|                                                                                                                      |                                                                                                                                   | 2024-25                                            |

### Professional Electives (4 Credits)

| S. No | Course Code | Courses                                  | L:T:P |
|-------|-------------|------------------------------------------|-------|
| 1     | UAITL50400  | Statistical Thinking for Data Science    | 3:1:0 |
| 2     | UAITL50401  | Big Data Analytics                       | 3:1:0 |
| 3     | UAITL50402  | Image and Video Processing               | 3:1:0 |
| 4     | UAITL50403  | Bioinformatics                           | 3:1:0 |
| 5     | UAITL50404  | Network Security and Cryptography        | 3:1:0 |
| 6     | UAITL60405  | Machine Learning for Data Science        | 3:1:0 |
| 7     | UAITL60406  | Predictive Analytics                     | 3:1:0 |
| 8     | UAITL60407  | Deep Learning for Computer Vision        | 3:1:0 |
| 9     | UAITL60408  | Genome Sequencing                        | 3:1:0 |
| 10    | UAITL60409  | Security Analytics                       | 3:1:0 |
| 11    | UAITL70410  | Reinforcement Learning                   | 3:1:0 |
| 12    | UAITL70411  | Pattern Recognition & Visual Recognition | 3:1:0 |
| 13    | UAITL70412  | Autonomous Systems                       | 3:1:0 |
| 14    | UAITL70413  | Algorithms for DNA Sequencing            | 3:1:0 |
| 15    | UAITL70414  | Privacy and Data Protection              | 3:1:0 |
| 16    | UAITL80415  | Solve Business Problems with AI          | 3:1:0 |
| 17    | UAITL80416  | AI in Gaming                             | 3:1:0 |
| 18    | UAITL80417  | AI in Healthcare                         | 3:1:0 |
| 19    | UAITL80418  | AI in Finance                            | 3:1:0 |

### Open Electives (3 Credits)

| S. No | Course Code | Courses                      | L:T:P |
|-------|-------------|------------------------------|-------|
| 1     | UAICO50400  | Machine Learning with Python | 2:0:2 |
| 2     | UAICO50401  | IOT                          | 2:0:2 |
| 3     | UAICO70402  | AI for Everyone              | 2:0:2 |
| 4     | UAICO70403  | Robotics                     | 2:0:2 |

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|                                                                                                                      |                                                                                                                                   | <b>B. Tech Course<br/>Structure &amp; Syllabus</b> |
|                                                                                                                      |                                                                                                                                   | 2024-25                                            |

## COURSE CONTENT/SYLLABUS

### SEMESTER- I

| <b>Engineering Chemistry</b>        |                   |                              |           |
|-------------------------------------|-------------------|------------------------------|-----------|
| <b>Semester:</b>                    | <b>I</b>          | <b>Internal Assessment</b>   | <b>30</b> |
| <b>Course Code:</b>                 | <b>UAITC11100</b> | <b>End Sem. Exam</b>         | <b>45</b> |
| <b>Teaching Hours/Week (L:T:P):</b> | <b>3:0:0</b>      | <b>Exam Duration (Hours)</b> | <b>2</b>  |
| <b>Credits: 3</b>                   |                   |                              |           |

#### PREREQUISITE(S)

Basic Chemistry

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

CO-1: Apply the chemistry knowledge in solving engineering problems of society.

CO-2: Understand the fundamentals of electrochemistry, polymer chemistry and water technology

CO-3: Assemble the concepts of chemistry that are in immediate need for engineering disciplines.

CO-4: Analyze various technologies available in electrochemistry, polymer chemistry, water & fuels.

CO-5: Develop problem solving skills using chemistry knowledge in an integrated approach.

#### DETAILED SYLLABUS

##### UNIT-I

**Electrochemistry:** Electro chemical cells – electrode potential, standard electrode potential, types of electrodes – calomel, Quinhydrone and glass electrode. Nernst equation Determination of pH of a solution by using quinhydrone and glass electrode. Electrochemical series and its applications. Numerical problems. Potentiometric titrations. Batteries – Primary (Lithium cell) and secondary batteries (Lead – acid storage battery and Lithium ion battery).

**Corrosion:** Causes and effects of corrosion, Types of corrosion, Corrosion control methods

**Battery Technology:** Classification of batteries, emf of batteries, Modern batteries. Fuel cells and their applications.

##### UNIT-II

**Polymer Chemistry:** Introduction, Classification of polymers, Use and disposal of polymers, Polymer terminologies, commercially important polymers with synthesis and applications (plastics, fibres, adhesives, elastomers, conducting polymers), properties of polymers Solubility, Molecular Weight, Crystallinity, Glass transition temperature, Role of additives in polymers, Reinforced plastics.

### UNIT-III

**Water Technology:** Chemical analysis of water. Hardness of water. Determination of dissolved oxygen (DO) by Winkler or Iodometric method. Reverse osmosis. Source of water pollution. Chemical oxygen demand (COD) and Biological oxygen demand (BOD). Treatment of domestic waste. Nano-technology associated with water.

### UNIT-IV

**Chemical fuels:** Introduction, classification with examples, calorific value-classification (HCV & LCV), determination of calorific value of solid and liquid fuels using Bomb calorimeter-numerical problems. Petroleum cracking -fluidized bed catalytic cracking. Reformation of petrol, Knocking in IC engine, its ill effects and prevention. Power alcohol and its advantages. Synthetic petrol – Bergius process. Renewable and non-renewable energies. Biofuel. Solar Energy. Nuclear fuel.

### Reference Books

1. Principles of Physical Chemistry by B.R.Puri, L.R.Sharma and M.S.Pathania, Nagin Chand and Co.
2. Text book of Physical Chemistry by Soni and Dharmatha, S.Chand & Sons.
3. Text book of Polymers science by Gowarikar and Vishwanathan.
4. Corrosion Engineering by M.G.Fontana, Mc Graw Hill Publications.
5. Introduction to Nanotechnology: Charles P. Poole, Frank J. Owens.

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|                                                                                                                      |                                                                                                                                   | B. Tech Course<br>Structure & Syllabus |
|                                                                                                                      |                                                                                                                                   | 2024-25                                |

## COURSE CONTENT/SYLLABUS

### SEMESTER- I

| Engineering Mathematics I    |            |                       |    |
|------------------------------|------------|-----------------------|----|
| Semester:                    | I          | Internal Assessment   | 30 |
| Course Code:                 | UAITC10101 | End Sem. Exam         | 45 |
| Teaching Hours/Week (L:T:P): | 3:0:0      | Exam Duration (Hours) | 2  |
| Credits: 3                   |            |                       |    |

### PREREQUISITE(S)

Basic Mathematics

### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

CO-1: Solve the consistent system of linear equations

CO-2: Apply orthogonal and congruent transformations to a quadratic form

CO-3: Determine the power series expansion of a given function

CO-4: Find the maxima and minima of multivariable functions

CO-5: Solve arbitrary order linear differential equations with constant coefficients

CO-6: Apply the concepts in solving physical problems arising in engineering

### DETAILED SYLLABUS

#### UNIT-I

**Matrix Theory:** Linear dependence and independence of vectors; Rank of a matrix; Consistency of the system of linear equations; Eigenvalues and eigenvectors of a matrix; Caley Hamilton theorem and its applications; Reduction to diagonal form; Reduction of a quadratic form to canonical form - orthogonal transformation and congruent transformation; Properties of complex matrices - Hermitian, skew-Hermitian and Unitary matrices.

#### UNIT-II

**Differential Calculus:** Taylor's theorem with remainders; Taylor's and Maclaurin's expansions; Asymptotes; Curvature; Curve tracing; Functions of several variables - partial differentiation; total differentiation; Euler's theorem and generalization; Change of variables - Jacobians; maxima and minima of functions of several variables (2 and 3 variables) - Lagrange's method of multipliers.

#### UNIT-III

**Ordinary differential equations of first order:** Formation of differential equations; variable separable equations; homogeneous and non-homogeneous equations; exact and non-exact equations; integrating factors; linear first order equations; Bernoulli's equation; applications Newton's law of cooling, Law of natural growth and decay, orthogonal trajectories.

## UNIT-IV

**Linear Differential Equations of Higher order:** Definition, Complete solution, Operator D, Rules for finding complementary function, Inverse operator, Rules for finding particular integral, Method of variation of parameters, Cauchy's and Legendre's linear equations, Simultaneous linear equations with constant coefficients and applications of linear differential equations to oscillatory Electrical Circuits L-C, LCR – Circuits.

## Reference Books

1. R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", Fifth Edition, Narosa Publishing House, 2016
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Eighth Edition, John Wiley and Sons, 2015
3. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publications, 2015

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|                                                                                                                      |                                                                                                                                   | B. Tech Course<br>Structure & Syllabus |
|                                                                                                                      |                                                                                                                                   | 2024-25                                |

## COURSE CONTENT/SYLLABUS

### SEMESTER- I

| Programming for Problem solving |            |                       |      |
|---------------------------------|------------|-----------------------|------|
| Semester:                       | I          | Internal Assessment   | 40   |
| Course Code:                    | UAITC10102 | End Sem. Exam         | 60   |
| Teaching Hours/Week (L:T:P):    | 3:1:0      | Exam Duration (Hours) | 2.30 |
| Credits: 4                      |            |                       |      |

#### PREREQUISITE(S)

None

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

- CO1: Formulate simple algorithms for arithmetic and logical problems.
- CO2: Test and execute the C programs and correct syntax and logical errors.
- CO3: Apply programming constructs of C language to solve the real-world problem.
- CO4: Design and develop solutions to problems using modular programming constructs using functions
- CO5: Apply user defined data structures like arrays, structures, unions and pointers in implementing solutions.

#### DETAILED SYLLABUS

##### UNIT-I

**Introduction to Programming:** Introduction to Computer, Components of a Computer System, Evolution of languages- Machine languages, Assembly languages, High-level languages. Software basics and its types. System software's like operating system, compiler, linker, loader; Application programs like editor.

**Idea of Algorithm:** steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples.

##### UNIT-II

**Introduction to 'C' Programming Language:** History of C Programming, Basic structure of C program, Executing a C program, Constants, Variables and Data types, Operators and Expressions, Programming examples and exercises.

##### UNIT-III

**Managing Input and Output operations:** Simple input and output with scanf and printf, formatted I/O, and Command line arguments.

**Conditional Branching and Loops:** Conditional branching Statements (if, if-else, nested if-else and switch statements) in C, Loop control statements (For, while-do, do-while) in C, break and continue, Programming examples and exercises.

## UNIT-IV

### **Arrays, Strings and Functions**

**Arrays:** Concepts, Using Arrays (1-D and 2-D) in C, Array Applications, Searching and Sorting algorithms (Linear search, Binary Search, Selection and Bubble Sort), example programs.

**Strings:** Introduction to strings in C, handling strings as array of characters, basic string functions available in C, arrays of strings.

**Functions:** Functions in C, user defined functions, Argument Passing – call by value, call by reference, Recursion, Programming examples and exercises.

**Storage Classes:** Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers.

## UNIT-V

### **Structures, Unions and Pointers, Preprocessor Directives:**

**Structures:** Basics of structures, Definition and Initialization of structures, unions, Array of structures, example programs.

**Pointers:** Idea of pointers, Defining pointers, pointers and functions (call by reference) arguments, pointers and arrays, example programs.

**Pre-processor directives:** Introduction to Preprocessors, compiler control Directives.

## Reference Books

1. Jacqueline Jones & Keith Harrow: Problem Solving with C, 1st Edition, Pearson 2011
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. Vikas Gupta: Computer Concepts and C Programming, Dreamtech Press 2013.
4. R S Bichkar, Programming with C, University Press, 2012.
5. Let us C ,Yashwanth Kanethkar, 13th Edition, BPB Publications.

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|                                                                                                                      |                                                                                                                                   | 2024-25                                            |

## COURSE CONTENT/SYLLABUS

### SEMESTER- I

| Basic Electrical Engineering        |                   |                              |           |
|-------------------------------------|-------------------|------------------------------|-----------|
| <b>Semester:</b>                    | <b>I</b>          | <b>Internal Assessment</b>   | <b>30</b> |
| <b>Course Code:</b>                 | <b>UAICC10100</b> | <b>End Sem. Exam</b>         | <b>45</b> |
| <b>Teaching Hours/Week (L:T:P):</b> | <b>2:0:2</b>      | <b>Exam Duration (Hours)</b> | <b>2</b>  |
| <b>Credits: 3</b>                   |                   |                              |           |

#### PREREQUISITE(S)

None

#### COURSE OUTCOMES

After completing this course successfully, the students will be able to:

- CO-1: Apply basic laws and analyze DC electrical circuits.
- CO-2: Apply basic laws and analyze AC electrical circuits.
- CO-3: Understand electrical machines working principle and their applications.
- CO-4: Understand domestic electrical safety, wiring and different measuring instrument.

#### DETAILED SYLLABUS

##### UNIT-I

**Basics of DC Circuits:** D. C. Circuits covering, Ohm's Law and Kirchhoff's Laws; Analysis of series, parallel and series-parallel circuits; Power and energy; Electromagnetism, Faradays Laws, Lenz's Law, Fleming's Rules, Statically and dynamically induced EMF.

##### UNIT-II

**Basics of AC Circuits:** Single Phase A.C. Circuits covering, Generation of sinusoidal voltage- definition of average value, root mean square value, form factor and peak factor of sinusoidal voltage and current and phasor representation of alternating quantities.

##### UNIT-III

#### Electrical Machines and Electrical safety

**DC Machines:** Working principle of DC machine as a generator and a motor.

**AC Machines:** Transformers, Principle of operation and construction of single phase transformers. Electrical safety, wiring and different measuring instrument

#### List of Experiments

1. Understanding basic electrical components, tools, domestic wiring and meters.
2. Demonstration of cut-out sections of AC & DC machines.
3. Verification of KCL and KVL for DC Circuit.
4. Two way and three-way control of lamp and formation of truth table.
5. Demonstration of significance of Pipe and Plate Earthing

## Reference Books

1. RituSahdev (2022), Basic Electrical Engineering, Khanna Book Publishing.
2. Nagrath I.J. and D. P. Kothari (2001), Basic Electrical Engineering, Tata McGraw Hill.

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|                                                                                                                      |                                                                                                                                   | <b>B. Tech Course<br/>Structure &amp; Syllabus</b> |
|                                                                                                                      |                                                                                                                                   | 2024-25                                            |

## COURSE CONTENT/SYLLABUS

### SEMESTER- I

| Communication Skills                |                   |                              |           |
|-------------------------------------|-------------------|------------------------------|-----------|
| <b>Semester:</b>                    | <b>I</b>          | <b>Internal Assessment</b>   | <b>30</b> |
| <b>Course Code:</b>                 | <b>UAICA10100</b> | <b>End Sem. Exam</b>         | <b>45</b> |
| <b>Teaching Hours/Week (L:T:P):</b> | <b>2:0:2</b>      | <b>Exam Duration (Hours)</b> | <b>2</b>  |
| <b>Credits: 3</b>                   |                   |                              |           |

#### PREREQUISITE(S)

None

#### COURSE OUTCOMES

After completion of course, students would be able to:

CO-1: Understand various technical writing skills and

CO-2: Apply technical writing and communication skills in their academic and professional life.

CO-3: Gain self-confidence with improved command over English.

CO-4: Understand the technical aspects of communication for better performance in extra curricular activities, recruitment process and prospective jobs.

#### DETAILED SYLLABUS

##### UNIT-I

**Fundamentals of Communication Skills:** Scope and Significance of Communication Skills, Listening, Speaking, Reading and Writing, Technical Communication, Tools of Effective Communication.

##### UNIT-II

**Writing Skills:** Basics of Grammar – Placing of Subject and Verb, Parts of Speech, Uses of Tenses, Active Passive, Narration.

##### UNIT-III

**Vocabulary Building and Writing:** Word Formation & Synonyms, Antonyms, Words Often Confused, One-Word Substitutes, Idioms and Phrasal Verbs, Abbreviations of Scientific and Technical Words.

##### UNIT-IV

**Speaking Skills:** Introduction to Phonetic Sounds & Articulation, Word Accent, Rhythm and Intonation, Interpersonal Communication, Oral Presentation, Body Language and Voice Modulation (Para linguistics and Non- Verbal), Negotiation and Persuasion, Group Discussion, Interview Techniques (Telephonic and Video Conferencing).

**Technical Writing:** Job Application, CV Writing, Business Letters, Memos, Minutes, Notices, Report Writing & Structure, E-mail Etiquette, Blog Writing.

### Reference Books

1. "The Essence of Effective Communication", Ludlow R. and Panton F., Pubs: Prentice Hall, 1992
2. "Effective Communication Skills", Kulbhushan Kumar, Khanna Publishing House, 2019.
3. "A University Grammar of English", Quirk R. and Sidney G., 3rd Edition, Pubs: Pearson Education, 2008
4. "High School English Grammar", Wren and Martin, Pubs: S. Chand & Company Ltd, 2007
5. "Essentials of Business Communication", Guffrey M.E., 8th Edition, Pubs: South-Western College Publishing, 2009
6. "Technical Communication: Principles and Practice", Raman M. and Sharma S., 2nd Edition, Pubs: Oxford University Press, 2012
7. "Effective Business Communication", Rodrigues M.V., Pubs: Concept Publishing Company, Delhi, 2003
8. "English Vocabulary in Use", McCarthy M. and Felicity O' Dell, 2nd Edition, Pubs: 2010

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|                                                                                                                      |                                                                                                                                   | 2024-25                                            |

## COURSE CONTENT/SYLLABUS

### SEMESTER- I

| <b>Environmental Science</b>        |                   |                              |           |
|-------------------------------------|-------------------|------------------------------|-----------|
| <b>Semester:</b>                    | <b>I</b>          | <b>Internal Assessment</b>   | <b>20</b> |
| <b>Course Code:</b>                 | <b>UAITA11100</b> | <b>End Sem. Exam</b>         | <b>30</b> |
| <b>Teaching Hours/Week (L:T:P):</b> | <b>2:0:0</b>      | <b>Exam Duration (Hours)</b> | <b>2</b>  |
| <b>Credits: 2</b>                   |                   |                              |           |

#### PREREQUISITE(S)

- Concept of environment.
- Basics of environment, ecology and technology.

#### COURSE OUTCOMES

After completing this Course, the students should be able to:

1. Identify the Components of Environment Ecosystem: Types & Structure, Scope and the Impacts of Agriculture & Housing, Industry, Mining & Transportation.
2. Ascertain the importance of. Natural Resources and different types of Energy.
3. Comprehend the Environmental Pollutions and Global Environmental Issues.
4. Examine the Air Pollution & Automobile Pollution their Effects and Solid Waste Management their sources, Characteristics.

#### DETAILED SYLLABUS

##### UNIT-I

**Introduction:** Environment - Components of Environment Ecosystem: Types & Structure of Ecosystem, Balanced ecosystem Human Activities – Food, Shelter, And Economic & Social Security. Impacts of Agriculture & Housing Impacts of Industry, Mining & Transportation. Environmental Impact Assessment, Sustainable Development.

**RBT Levels: L1, L2.**

##### UNIT-II

**Natural Resources, Water resources:** Availability & Quality aspects, Water borne diseases & water induced diseases, Fluoride problem in drinking water Mineral resources, Forest Wealth Material Cycles – Carbon Cycle, Nitrogen Cycle & Sulphur Cycle. Energy: Different types of energy, Conventional sources & Non-Conventional sources of energy Solar energy, Hydro electric energy, Wind Energy, Nuclear energy, Biomass & Biogas Fossil Fuels, Hydrogen as an alternative energy.

**RBT Levels: L1, L2.**

##### UNIT-III

**Environmental Pollution:** Water Pollution, Noise pollution, Land Pollution, Public Health Aspects. Global Environmental Issues: Population Growth, Urbanization, Land Management,

Water & Waste Water Management.

**RBT Levels: L1, L2.**

#### UNIT-IV

**Air Pollution & Automobile Pollution:** Definition, Effects – Global Warming, Acid rain & Ozone layer depletion, controlling measures. Solid Waste Management, E - Waste Management & Biomedical Waste Management - Sources, Characteristics & Disposal methods.

**RBT Levels: L1, L2, L3.**

#### Reference Books

1. Raman Sivakumar, “Principals of Environmental Science and Engineering”, Second Edition, Cengage learning Singapore, 2005 63 64 2.
2. P. Meenakshi, “Elements of Environmental Science and Engineering”, Prentice Hall of India Private Limited, New Delhi, 2006
3. S.M. Prakash, “Environmental Studies”, Elite Publishers Mangalore, 2007 4. Erach Bharucha, “Text Book of Environmental Studies”, for UGC, University press, 2005
4. Erach Bharucha, “Text Book of Environmental Studies”, for UGC, University press, 2005
5. G.Tyler Miller Jr., “Environmental Science – working with the Earth”, Tenth Edition, Thomson Brooks /Cole, 2004
6. G.Tyler Miller Jr., “Environmental Science – working with the Earth”, Eleventh Edition, Thomson Brooks /Cole, 2006
7. Dr.Pratiba Sing, Dr.Anoop Singh and Dr.Piyush Malaviya, “Text Book of Environmental and Ecology”, Acme Learning Pvt. Ltd. New Delhi

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|                                                                                                                      |                                                                                                                                   | B. Tech Course<br>Structure & Syllabus |
|                                                                                                                      |                                                                                                                                   | 2024-25                                |

## COURSE CONTENT/SYLLABUS

### SEMESTER- I

| Computer Aided Engineering Graphics |                   |                              |           |
|-------------------------------------|-------------------|------------------------------|-----------|
| <b>Semester:</b>                    | <b>I</b>          | <b>Internal Assessment</b>   | <b>10</b> |
| <b>Course Code:</b>                 | <b>UAIPC10100</b> | <b>End Sem. Exam</b>         | <b>15</b> |
| <b>Teaching Hours/Week (L:T:P):</b> | <b>0:0:2</b>      | <b>Exam Duration (Hours)</b> | <b>1</b>  |
| <b>Credits: 1</b>                   |                   |                              |           |

#### PREREQUISITE(S)

None

#### COURSE OUTCOMES

After studying this course the student will be able to

CO-1: Understand the points with all quadrant systems.

CO-2: Understand the lines drawing in first quadrant systems.

CO-3: Apply the concepts of planes to draw the projections.

#### DETAILED SYLLABUS

##### UNIT-I

**Introduction to Computer Aided Sketching:** Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning and free hand practicing. Introduction to Solid Edge standard toolbar/menus. Co-ordinate system, points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, parallelism, inclination and perpendicularity. Dimensioning conventions.

##### UNIT-II

**Orthographic Projections:** Projections of points, Projections of straight lines (First Angle Projection), True and apparent lengths and Projections of plane surfaces.

#### Reference Books

1. Bhatt N.D., Panchal V.M. & Ingle P.R. (2014), Engineering Drawing, Charotar Publishing House.
2. A Primer on Computer Aided Engineering Drawing-2006, Published by VTU, Belgaum.
3. Fundamentals of Engineering Drawing with an Introduction to Interactive Computer
4. Graphics for Design and Production- by Luzadder Warren J., Duff John M., Eastern Economy
5. Edition, 2005- Prentice Hall of India Pvt. Ltd., New Delhi.
6. Engineering Graphics by K.R. Gopalakrishna, 32nd edition, 2005- Subash Publishers Bangalore.

7. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
8. Agrawal B. & Agrawal C.M. (2012), Engineering Graphics, TMH Publication
9. Engineering Graphics & Design, A.P. Gautam & Pradeep Jain Khanna Publishing House
10. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.  
(Corresponding set of) CAD Software Theory and User Manuals.
11. <https://nptel.ac.in/courses/112/103/112103019/#> (online resource)

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|                                                                                                                      |                                                                                                                                   | <b>B. Tech Course<br/>Structure &amp; Syllabus</b> |
|                                                                                                                      |                                                                                                                                   | 2024-25                                            |

## COURSE CONTENT/SYLLABUS

### SEMESTER- I

| <b>Programming for Problem Solving Lab</b> |                   |                              |           |
|--------------------------------------------|-------------------|------------------------------|-----------|
| <b>Semester:</b>                           | <b>I</b>          | <b>Internal Assessment</b>   | <b>20</b> |
| <b>Course Code:</b>                        | <b>UAIPC10101</b> | <b>End Sem. Exam</b>         | <b>30</b> |
| <b>Teaching Hours/Week (L:T:P):</b>        | <b>0:0:4</b>      | <b>Exam Duration (Hours)</b> | <b>2</b>  |
| <b>Credits: 2</b>                          |                   |                              |           |

### PREREQUISITE(S)

None

### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

CO1: Develop algorithms, flowchart and C programs for solving problems.

CO2: Identify and correct the syntax and logical errors of the program.

CO3: Construct a programming solution to the given real-world problem using C.

CO4: Design and develop modular programming skills.

CO5: Demonstrate use of arrays, strings, structures, unions and pointers in problem solving.

### LABORATORY PROGRAMS

#### PART-A

1. Program to find the Biggest of 3 numbers.
2. Program to simulate the Simple calculator (Addition, subtraction, multiplication, division and modulo).
3. Program to compute the roots of a quadratic equation by accepting the coefficients. Print appropriate messages.
4. Program to read an integer 'n' and print whether 'n' is a prime number or not.
5. Program to find the reverse of a positive integer and check for palindrome or not. Display appropriate messages.
6. Program to generate the Floyds triangle.
7. Program to Implement the Linear Search.
8. Program to Sort the given set of N numbers using Selection Sort.
9. Program to Sort the given set of N numbers using Bubble sort.
10. Write functions to implement string operations such as compare, concatenate, string length. Convince the parameter passing techniques.

#### PART-B

1. Program to implement Binary Search on Integers / Names.
2. Program to implement Matrix multiplication and validate the rules of multiplication.
3. Program to implement using functions to check whether the given number is prime or not and display appropriate messages.
4. Program to implement Recursive function to generate Fibonacci series.

5. Program to implement structures to read, write and compute average- marks and the students scoring above and below the average marks for a class of N students.
6. Develop a program using pointers to compute the sum, mean and standard deviation of all elements stored in an array of N real numbers.

**NOTE:** Students are allowed to pick one program from PART-A and one program from PART-B and are given equal opportunity. So, students have to write and execute two programs in total.

## COURSE ASSESSMENT

### A. Internal Assessment: 20 Marks

**Marks Distribution** (Subjected to change based on the decision of faculty in charge):

- IA + Preparation of lab manual = 15 + 5 = 20 Marks
- One internal assessment (IA) of 15 marks will be conducted for each part (A & B) and average marks of two IA will be considered.
- Marks distribution for 15 marks IA in each part:  
Procedure + Execution + Viva = 3 + 9 + 3 = 15
- Remaining 5 marks will be given for writing lab manual consisting of Algorithm, Flowchart, Program and outputs for every experiment.

### B. End Semester Examination: 30 Marks

- Students are allowed to pick one program from PART-A and one program from PART-B and are given equal opportunity. So, students have to write and execute two programs in total.
- **Marks Distribution**
  - I. PART-A Experiment – Procedure + Execution + Viva = 3 + 9 + 3 = 15 Marks
  - II. PART-B Experiment – Procedure + Execution + Viva = 3 + 9 + 3 = 15 Marks

|                                                                                                                      |                                                                                                                                   |                                        |
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|                                                                                                                      |                                                                                                                                   | B. Tech Course<br>Structure & Syllabus |
|                                                                                                                      |                                                                                                                                   | 2024-25                                |

## COURSE CONTENT/SYLLABUS

### SEMESTER- II

| Engineering Physics                 |                   |                              |           |
|-------------------------------------|-------------------|------------------------------|-----------|
| <b>Semester:</b>                    | <b>II</b>         | <b>Internal Assessment</b>   | <b>30</b> |
| <b>Course Code:</b>                 | <b>UAITC20103</b> | <b>End Sem. Exam</b>         | <b>45</b> |
| <b>Teaching Hours/Week (L:T:P):</b> | <b>3:0:0</b>      | <b>Exam Duration (Hours)</b> | <b>2</b>  |
| <b>Credits: 3</b>                   |                   |                              |           |

#### PREREQUISITE(S)

Basic Physics

#### COURSE OUTCOMES

After completion of this course the student will be able to

- CO-1: Solve 1 D problems in quantum mechanics
- CO-2: Explain the basis of energy bands and gaps in solids and semiconductors
- CO-3: Analyze and solve problem involving variety of wave phenomena
- CO-4: Apply principles of electromagnetism and Maxwells equation to simple systems
- CO-5: Explain principles and techniques used in the field of nanoscience

#### DETAILED SYLLABUS

##### UNIT-I

**Waves and Oscillations:** Rectilinear motion, Oscillations or Vib rations, Simple Harmonic Motion, Damped Harmonic motion: Real oscillatory system, Forced or Driven oscillation, Types of Wave; Superposition of Waves, Reflection and Refraction, Standing Waves and Normal Modes, Beats, Resonance, Doppler's Effect

##### UNIT-II

**Electricity and Magnetism:** Physical concepts of gradient, divergence, and curl; Laplacian operator, Concept of electricity and magnetism, Coulomb's law, The Lorentz force, Maxwell's equations

##### UNIT-III

**Introduction to Solids and Semiconductors:** Introduction to Quantum Mechanics, Free electron theory of metals, Fermi level, density of states in 1, 2 and 3 dimensions, Kronig Penney model and origin of energy bands, metals, semiconductors, and insulators.

##### UNIT-IV

**Introduction to nanoscience:** Origin of nanoscience, nanoscale, surface to volume ratio, quantum confinement, dominance of electromagnetic forces, random molecular motion, bottom-up fabrication: Sol-gel, CVD and PVD techniques, top-down fabrication: ball mill method, characterization by XRD, SEM and TEM.

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### Reference Books

1. G. Main, “Vibrations and waves in physics”, Cambridge University Press, 1993.
2. H. J. Pain, “The physics of vibrations and waves”, Wiley, 2006.
3. D. A. Neamen, “Semiconductor Physics and Devices”, Times Mirror High Education Group, Chicago, 1997.
4. E.S. Yang, “Microelectronic Devices”, McGraw Hill, Singapore, 1988.
5. B.G. Streetman, “Solid State Electronic Devices”, Prentice Hall of India, 1995.

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|                                                                                                                      |                                                                                                                                   | <b>B. Tech Course<br/>Structure &amp; Syllabus</b> |
|                                                                                                                      |                                                                                                                                   | 2024-25                                            |

## COURSE CONTENT/SYLLABUS

### SEMESTER- II

| <b>Engineering Mathematics II</b>   |                   |                              |           |
|-------------------------------------|-------------------|------------------------------|-----------|
| <b>Semester:</b>                    | <b>II</b>         | <b>Internal Assessment</b>   | <b>30</b> |
| <b>Course Code:</b>                 | <b>UAITC20104</b> | <b>End Sem. Exam</b>         | <b>45</b> |
| <b>Teaching Hours/Week (L:T:P):</b> | <b>3:0:0</b>      | <b>Exam Duration (Hours)</b> | <b>2</b>  |
| <b>Credits: 3</b>                   |                   |                              |           |

### PREREQUISITE(S)

Mathematics-I

### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

CO-1: Analyze improper integrals

CO-2: Evaluate multiple integrals in various coordinate systems

CO-3: Apply the concepts of gradient, divergence and curl to formulate engineering problems

CO-4: Convert line integrals into area integrals and surface integrals into volume integrals

CO-5: Apply Laplace transforms to solve physical problems arising in engineering

### DETAILED SYLLABUS

#### UNIT-I

**Integral Calculus:** Convergence of improper integrals; Beta and Gamma integrals; Differentiation under integral sign; Double and Triple integrals - computation of surface areas and volumes; change of variables in double and triple integrals.

#### UNIT-II

**Vector Calculus:** Scalar and vector fields; vector differentiation; level surfaces; directional derivative; gradient of a scalar field; divergence and curl of a vector field; Laplacian; Line and Surface integrals; Green's theorem in a plane; Stoke's theorem; Gauss Divergence theorem

#### UNIT-III

**Laplace Transforms:** Laplace transforms; inverse Laplace transforms; Properties of Laplace transforms; Laplace transforms of unit step function, impulse function, periodic function; Convolution theorem; Applications of Laplace transforms - solving certain initial value problems, solving system of linear differential equations, finding responses of systems to various inputs viz. sinusoidal inputs acting over a time interval, rectangular waves, impulses etc.

### Reference Books

1. R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", Fifth Edition, Narosa Publishing House, 2016
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Eighth Edition, John Wiley and Sons, 2015
3. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publications, 2015

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|                                                                                                                      |                                                                                                                                   | 2024-25                                            |

## COURSE CONTENT/SYLLABUS

### SEMESTER- II

| <b>Object-Oriented Programming using Java</b> |                   |                              |             |
|-----------------------------------------------|-------------------|------------------------------|-------------|
| <b>Semester:</b>                              | <b>II</b>         | <b>Internal Assessment</b>   | <b>40</b>   |
| <b>Course Code:</b>                           | <b>UAITC20105</b> | <b>End Sem. Exam</b>         | <b>60</b>   |
| <b>Teaching Hours/Week (L:T:P):</b>           | <b>3:1:0</b>      | <b>Exam Duration (Hours)</b> | <b>2.30</b> |
| <b>Credits: 4</b>                             |                   |                              |             |

### PREREQUISITE(S)

Students should have the knowledge of procedure oriented programming.

### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

- CO-1: Distinguish between object oriented paradigm and the procedure oriented paradigm. (Level 2: Understand)
- CO-2: Explain the basic principles of object-oriented design. (Level 2: Understand)
- CO-3: Write Java application programs using OOP principles and proper program structuring. (Level 3: Apply)
- CO-4: Create packages and interfaces. (Level 6: Create)
- CO-5: Apply practical experience gained in designing and constructing data models using java programming. (Level 3: Apply)

### DETAILED SYLLABUS

#### UNIT-I

The History and Evolution of Java, C++: The Next Step, The Creation of Java, The Bytecode, The Java Buzzwords, Object-Oriented concepts, The Evolution of Java. Object-Oriented Programming, A First Simple Program.

#### UNIT-II

Variables and data types, Control Statements, Identifiers, Literals The Java Keywords, The Java Class Libraries. Introducing Classes, Class Fundamentals, A Simple Class, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Returning a Value, Constructors, Garbage Collection, The finalize( ) Method.

#### UNIT-III

Inheritance Basics, Member Access and Inheritance, Using super, Creating a Multilevel Hierarchy, Method Overriding, Using Abstract Classes, Using final with Inheritance, Using final to Prevent Overriding, Using final to Prevent Inheritance.

#### UNIT-IV

Packages and Interfaces, nested interfaces, variable in interfaces, Exception handling, exception types.

## Reference Books

1. E. Balaguruswamy, Programming with Java, A primer, 4th Edition, Tata McGraw-Hill Publications. Herbert Schildt, The Complete Reference Java, Seventh Edition, MCGrawHill
2. Paul Deitel & Harvey Deitel (2015), Java: How to Program, 10th Edition, Pearson Education.
3. Robert Lafore (2002), Object Oriented Programming in C++, 4th Edition, Galgotia publications.
4. Herbert Schildt (2002), JavaTM2 the Complete Reference, 5th Edition, Tata McGraw-Hill.

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|                                                                                                                      |                                                                                                                                   | 2024-25                                            |

## COURSE CONTENT/SYLLABUS

### SEMESTER- II

| <b>Basic Electronics</b>            |                   |                              |           |
|-------------------------------------|-------------------|------------------------------|-----------|
| <b>Semester:</b>                    | <b>II</b>         | <b>Internal Assessment</b>   | <b>30</b> |
| <b>Course Code:</b>                 | <b>UAICC20101</b> | <b>End Sem. Exam</b>         | <b>45</b> |
| <b>Teaching Hours/Week (L:T:P):</b> | <b>2:0:2</b>      | <b>Exam Duration (Hours)</b> | <b>2</b>  |
| <b>Credits: 3</b>                   |                   |                              |           |

#### PREREQUISITE(S)

None

#### COURSE OUTCOMES

After completing this course, the students should be able to:

- CO-1: Describe the operation of Diodes and BJT
- CO-2: Design and explain the construction of rectifiers, regulators, and amplifiers.
- CO-3: Describe the general operating principles of optoelectronic devices and photodetectors.
- CO-4: Explain the different number system and their conversions and construct simple combinational and sequential logic circuits using Flip-flops.

#### DETAILED SYLLABUS

##### UNIT-I

**Semiconductors:** Bonding forces in solids, Energy bands, Metals, Semiconductors and Insulators, Direct and Indirect semiconductors, Electrons and Holes, Intrinsic and Extrinsic materials, Conductivity and Mobility, Drift and Resistance, Effects of temperature and doping on mobility, Hall Effect.

##### UNIT-II

**Forward and Reverse biased junctions:** Qualitative description of Current flow at a junction, Reverse bias, Reverse bias breakdown- Zener breakdown, avalanche breakdown, Rectifiers. Optoelectronic Devices, Photodiodes: Current and Voltage in an Illuminated Junction, Solar Cells, Photodetectors. Light Emitting Diode.

##### UNIT-III

**Digital Electronics Fundamentals:** Difference between analog and digital signals, Number system – Binary, Hexadecimal, Conversion – Decimal to binary, Hexagonal to decimal and vice-versa, Boolean

Algebra, Basic to Universal gates, Half and full adder, Multiplexer, Decoder, SR and JK flip-flops, Shift register, 3 bit Ripple counter

### List of Experiments

1. Analyze the I-V Characteristics of normal PN Junction.
2. Analyze the I-V Characteristics of the Zener Diode.
3. Study and Analyze the I-V Characteristics of the CE Configuration of BJT.
4. Study and Analyze the I-V Characteristics of the CB Configuration of BJT.
5. Study and Analyze the I-V Characteristics of the CC Configuration of BJT.
6. To construct a Half-wave rectifier circuit and analyze its output.

### Reference Books

1. Ben. G. Streetman, Sanjay Kumar Banerjee, "Solid State Electronic Devices", 7<sup>th</sup> Edition, Pearson
2. Education, 2016, ISBN 978-93-325-5508-2.
3. Thomas L. Floyd, "Electronic Devices" Pearson Education, 9th Edition, 2012.
4. D.P. Kothari, I.J. Nagarath, "Basic Electronics," 2nd Edn. McGraw Hill, 2018.
5. S. M. Sze, Kwok K. Ng, "Physics of Semiconductor Devices," 3rd Edition, Wiley, 2018.

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|                                                                                                                      |                                                                                                                                   | B. Tech Course<br>Structure & Syllabus |
|                                                                                                                      |                                                                                                                                   | 2024-25                                |

## COURSE CONTENT/SYLLABUS

### SEMESTER- II

| Discrete Mathematical Structures |            |                       |      |
|----------------------------------|------------|-----------------------|------|
| Semester:                        | II         | Internal Assessment   | 40   |
| Course Code:                     | UAITC20106 | End Sem. Exam         | 60   |
| Teaching Hours/Week (L:T:P):     | 3:1:0      | Exam Duration (Hours) | 2.30 |
| Credits: 4                       |            |                       |      |

#### PREREQUISITE(S)

None

#### COURSE OUTCOMES

After completion of course, students would be able to:

CO-1: Understand the basics of various discrete structures.

CO-2: Apply applications of discrete structures in Computer Science and Engineering.

#### DETAILED SYLLABUS

##### UNIT-I

**Mathematical Reasoning:** Mathematical reasoning, Propositions, Negation, disjunction and conjunction, Implication and Equivalence, Truth tables, Predicates, Quantifiers, Natural deduction, Rules of Inference, Methods of proofs, Resolution principle, Application to PROLOG.

##### UNIT-II

**Set Theory:** Paradoxes in set theory, Inductive definition of sets and proof by induction, Peano postulates, Relations, Properties of relations, Equivalence Relations and partitions, Partial orderings, Posets, Linear and well-ordered sets.

##### UNIT-III

**Combinatorics and Functions:** Elementary Combinatorics, counting techniques, Recurrence relation, Generating functions, Functions; mappings, Injection and Surjections, Composition of functions, Inverse functions, Special functions, Pigeonhole principle, Recursive function theory.

##### UNIT-IV

**Graph Theory:** Elements of graph theory, Euler graph, Hamiltonian path, trees, Tree traversals, Spanning trees, Representation of relations by graphs.

### Reference Books

1. K. H. Rosen, Discrete Mathematics and applications, 6th Edition, Tata McGraw Hill 2007.
2. S.B. Singh, Discrete Structures/ 3rd Edition, Khanna Book Publishing, 2019.
3. S.B. Singh, Combinatorics and Graph Theory/ 3rd Edition, Khanna Book Publishing, 2018.
4. C. L. Liu, Elements of Discrete Mathematics, 2nd Edn., Tata McGraw-Hill 2000.
5. J.L. Mott, A. Kandel, T.P .Baker, Discrete Mathematics for Computer Scientists and Mathematicians, Second edition, Prentice Hall of India 1986.
6. W. K. Grassmann and J. P. Tremblay, Logic and Discrete Mathematics, A Computer Science Perspective, Prentice Hall Inc 1996

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|                                                                                                                      |                                                                                                                                   | B. Tech Course<br>Structure & Syllabus |
|                                                                                                                      |                                                                                                                                   | 2024-25                                |

## COURSE CONTENT/SYLLABUS

### SEMESTER- II

| Design Thinking              |            |                       |    |
|------------------------------|------------|-----------------------|----|
| Semester:                    | II         | Internal Assessment   | 10 |
| Course Code:                 | UAIPA20100 | End Sem. Exam         | 15 |
| Teaching Hours/Week (L:T:P): | 0:0:2      | Exam Duration (Hours) | 1  |
| Credits: 1                   |            |                       |    |

#### PREREQUISITE(S)

None

#### COURSE OUTCOMES

Student will able to

- CO-1: Compare and classify the various learning styles and memory techniques and Apply them in their engineering education
- CO-2: Analyze emotional experience and Inspect emotional expressions to better understand users while designing innovative products
- CO-3: Develop new ways of creative thinking and Learn the innovation cycle of Design Thinking process for developing innovative products
- CO-4: Propose real-time innovative engineering product designs and Choose appropriate frameworks, strategies, techniques during prototype development
- CO-4: Perceive individual differences and its impact on everyday decisions and further Create a better customer experience

#### DETAILED SYLLABUS

##### UNIT-I

**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

##### UNIT-II

**Emotions: Experience & Expression:** Understanding Emotions: Experience & Expression, Assessing Empathy, Application with Peers

**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

##### UNIT-III

**Being Ingenious & Fixing Problem:** Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving

**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.

#### UNIT-IV

**Prototyping & Testing:** What is Prototype? Why Prototype? Rapid Prototype Development process, Testing, Sample Example, Test Group Marketing

**Celebrating the Difference:** Understanding Individual differences & Uniqueness, Group Discussion and Activities to encourage the understanding, acceptance and appreciation of Individual differences

**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

**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”.

#### Reference Books

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, Harper Collins Publishers Ltd.
2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons Inc
3. Brenda Laurel Design Research methods and perspectives MIT press 2003
4. Terwiesch, C. & Ulrich, K.T., 2009. Innovation Tournaments: creating and identifying Exceptional Opportunities, Harvard business press.
5. Ulrich & Eppinger, Product Design and Development, 3rd Edition, McGraw Hill, 2004
6. Stuart Pugh, Total Design: Integrated Methods for Successful Product Engineering, Bjarki Hallgrímsson, Prototyping and model making for product design, 2012, Laurence King Publishing Ltd
7. Kevin Henry, Drawing for Product designers, 2012, Laurence King Publishing Ltd

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|                                                                                                                      |                                                                                                                                   | 2024-25                                            |

## COURSE CONTENT/SYLLABUS

### SEMESTER- II

| <b>OOPS using Java Lab</b>          |                   |                              |           |
|-------------------------------------|-------------------|------------------------------|-----------|
| <b>Semester:</b>                    | <b>II</b>         | <b>Internal Assessment</b>   | <b>10</b> |
| <b>Course Code:</b>                 | <b>UAIPC20102</b> | <b>End Sem. Exam</b>         | <b>15</b> |
| <b>Teaching Hours/Week (L:T:P):</b> | <b>0:0:2</b>      | <b>Exam Duration (Hours)</b> | <b>1</b>  |
| <b>Credits: 1</b>                   |                   |                              |           |

### PREREQUISITE(S)

None

### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

CO1: Develop algorithms, flowchart and Java programs for solving problems.

CO2: Identify and correct the syntax and logical errors of the program.

CO3: Construct a programming solution to the given real-world problem using Java.

CO4: Design and develop modular programming skills.

CO5: Demonstrate use of arrays, strings, structures, unions and pointers in problem solving.

### LABORATORY PROGRAMS

#### PART-A

1. Write a Java Program to demonstrate arithmetic operation (+,-,\*,/,%)
2. Write a Java Program to compute area of rectangle and circle
3. Write a Java Program to find odd and even number
4. Write a Java Program to display triangle using escape sequences
5. Write a Java Program to compute the sum of n natural numbers
6. Write a Java Program to read the input for 6 courses (MM 100), then calculate percentage and display grade
7. Write a Java Program to sort the names using String Concept
8. Write a Java Program to search an element from 2D matrix
9. Write a Java Program to demonstrate dynamic array concept called vector class (Operations: add element, delete element, search element, sort elements)
10. Write a Java Program to demonstrate static keyword with suitable real time example

#### PART-B

1. Write a Java Program to demonstrate single inheritance for computing percentage of 6 different courses then calculate the grade of student
2. Write a Java Program to demonstrate method overloading for flying (take-off) and landing of Plane
3. Write a Java Program to demonstrate method overriding with suitable real time

example

4. Write a Java Program to demonstrate package execution with suitable real time example
5. Write a Java Program to demonstrate exception handling.
6. Write a Java Program to demonstrate exception handling with finally Keyword.
7. Write a Java Program to demonstrate exception handling with multiple catch block.
8. Write a Java Program to demonstrate user defined exception for validation of age to the voting system.
9. Write a Java Program for validation of eligibility criteria for Phd admission in CS Department using exception handling.
10. Write a Java Program to demonstrate single thread concept to check prime number.
11. Write a Java Program to demonstrate multithreading concept.
12. Write a Java Program to demonstrate multitask of ATM system.  
{withdraw(),balance(),miniStatement()}.

### COURSE ASSESSMENT

#### C. Internal Assessment: 20 Marks

**Marks Distribution** (Subjected to change based on the decision of faculty in charge):

- IA + Preparation of lab manual = 15 +5 = 20 Marks
- One internal assessment (IA) of 15 marks will be conducted for each part (A & B) and average marks of two IA will be considered.
- Marks distribution for 15 marks IA in each part:  
Procedure + Execution +Viva = 3+9+3 = 15
- Remaining 5 marks will be given for writing lab manual consisting of Algorithm, Flowchart, Program and outputs for every experiment.

#### D. End Semester Examination: 30 Marks

- Students are allowed to pick one program from PART-A and one program from PART-B and are given equal opportunity. So, students have to write and execute two programs in total.
- **Marks Distribution**
  - I. PART-A Experiment – Procedure + Execution +Viva = 3 + 9 +3 =15 Marks
  - II. PART-B Experiment – Procedure + Execution +Viva = 3 + 9 +3 =15 Marks

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|                                                                                                                      |                                                                                                                                   | <b>B. Tech Course<br/>Structure &amp; Syllabus</b> |
|                                                                                                                      |                                                                                                                                   | 2024-25                                            |

## COURSE CONTENT/SYLLABUS

### SEMESTER- III

| <b>Mathematical Concepts for AI</b> |                   |                              |           |
|-------------------------------------|-------------------|------------------------------|-----------|
| <b>Semester:</b>                    | <b>III</b>        | <b>Internal Assessment</b>   | <b>30</b> |
| <b>Course Code:</b>                 | <b>UAITC30200</b> | <b>End Sem. Exam</b>         | <b>45</b> |
| <b>Teaching Hours/Week (L:T:P):</b> | <b>3:0:0</b>      | <b>Exam Duration (Hours)</b> | <b>2</b>  |
| <b>Credits: 3</b>                   |                   |                              |           |

#### PREREQUISITE(S)

None

#### COURSE OUTCOMES

After completion of course, students would be able to:

CO-1: To understand the mathematical background of AI.

CO-2: Use statistical methods to analyze and collect data.

CO-3: Use probability and statistics to analyze data

CO-4: Use and apply hypothesis testing on different datasets

#### DETAILED SYLLABUS

##### UNIT-I

**Equations, Functions and Graphs:** Introduction to linear equations, Intercepts and slopes, System of equations, Exponentials, radicals and logarithms, Polynomials, Polynomial operations, Factorizations, Introduction to quadratic equations, Functions

##### UNIT-II

**Derivatives and Optimizations:** Rate of change, Introduction to limits, Continuity, finding limits, Differentiability, Derivative rules and operations, using derivatives to analyse functions, Second order derivatives, Optimization functions, Multivariate differentiation

##### UNIT-III

**Vectors and Matrices :** Introduction to vectors, Vector addition, vector multiplication, Introduction to matrices, matrix multiplication, properties of matrices, types of matrices, Matrix division, solving system of equations with matrices, Matrix transformations, Eigen values and eigen vectors, rank of matrix

##### UNIT-IV

**Probability:** Basic rules and axioms events, sample space, dependent and independent events, conditional probability, Random variables- continuous and discrete, expectation, variance, distributions- joint and conditional, Bayes' Theorem, Popular distributions- binomial, Bernoulli, poisson, exponential, Gaussian

**Statistics:** Fundamentals of Data: Collection, Summarization, and Visualization; Sampling and Sampling Distributions, Central Limit Theorem; Methods of Estimation, Unbiased

estimators; Confidence Interval Estimation: Z-interval, t-interval; Hypothesis Testing, Types of Errors, Rejection Region Approach and p-value Approach.

### Reference Books

1. Mathematics for Machine Learning, Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Cambridge University Press., 2020
2. Advanced Engineering Mathematics, Reena Garg, Khanna Book Publishing Co., Delhi.
3. Machine Learning, Rajiv Chopra, Khanna Book Publishing Co., Delhi.
4. Introduction to Applied Linear Algebra: Vectors, Matrices, and Least Squares, Stephen Boyd, Lieven Vandenberghe, Cambridge University Press., 2018
5. Probability and statistics for Engineers and Scientists, Walpole, Myers, Myers and Ye, Pearson Education, 2012
6. Advanced Engineering Mathematics, Wylie and Barrett, McGraw Hill, 1995
7. <https://www.udemy.com/course/mathematical-foundation-for-machine-learning-and-ai/>

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|                                                                                                                      |                                                                                                                                   | 2024-25                                            |

## COURSE CONTENT/SYLLABUS

### SEMESTER- III

| <b>Computer Organization and Architecture</b> |                   |                              |             |
|-----------------------------------------------|-------------------|------------------------------|-------------|
| <b>Semester:</b>                              | <b>III</b>        | <b>Internal Assessment</b>   | <b>40</b>   |
| <b>Course Code:</b>                           | <b>UAITC30201</b> | <b>End Sem. Exam</b>         | <b>60</b>   |
| <b>Teaching Hours/Week (L:T:P):</b>           | <b>3:1:0</b>      | <b>Exam Duration (Hours)</b> | <b>2.30</b> |
| <b>Credits: 4</b>                             |                   |                              |             |

#### PREREQUISITE(S)

- The students should hold basic knowledge of Computers.
- The students should hold the skill set of basic Algebra.

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

CO-1: Summarize the concepts of Number system, Boolean algebra and Logic gates.

(Level 5: Evaluate)

CO-2: Experiment on Simplification of Boolean functions and Sequential Circuits. (Level 4: Analyze)

CO-3: Prepare an architectural logic and control design for the processor. (Level 3: Apply)

CO-4: Describe the basic concepts of microprocessors. (Level 2: Understand)

CO-5: Discuss the structure of memory and its components. (Level 2: Understand)

#### DETAILED SYLLABUS

##### UNIT-I

**Number System:** Introduction, Decimal, Binary, Octal, Hexadecimal, 1's and 2's Complements, Inter conversion of numbers, Codes: Character codes – ASCII, EBCDIC, Binary Addition, Binary Subtraction, Signed Numbers, Addition /Subtraction of numbers in 2's complement notation, Binary Multiplication, Binary division, Floating point representation of numbers, Arithmetic operations with normalized floating point numbers.

**Boolean Algebra and Logic Gates:** Introduction, Basic definition, Axiomatic Definition, Basic theorem and Properties of Boolean algebra, Minterms and Maxterms, Logic Operations, Digital logic gates, IC digital logic families.

##### UNIT-II

**Simplification of Boolean functions:** Introduction, Different types of map method, product of sum simplification, NAND or NOR implementation, don't care condition,

**Combinational and Sequential Circuits:** Introduction, Half-adder, Full-Adder, Subtractors, Universal Gates, Flip-flops (SR, JK, D & T), Edge Triggering of Flip-Flops.

##### UNIT-III

**Digital Components:** Integrated circuits, Decoders, Encoders, Multiplexers, Registers, Shift Registers, Counters, Binary Counter with Parallel Load, Memory Unit

**Basic Computer Organization and Design:** Stored Program Organization and

InstructionCodes, Computer Registers, Common Bus System, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output, Program Interrupt and Design of Accumulator Logic.

#### UNIT-IV

**Input-Output Organization:** Peripheral Devices, Input-Output Interface, Synchronous and Asynchronous Data Transfer, Handshaking, Modes of Transfer, Programmed I/ O and Interrupt initiated I/O , Priority Interrupt, Interrupt cycle, Direct Memory Access (DMA), Serial Communication.

**Memory System Design:** Memory Origination, Memory Hierarchy, Main Memory (RAM/ROM chips), Auxiliary memory, Associative memory, Cache Memory and Virtual Memory.

#### Reference Books

1. M. Morris Mano (2007), Computer System Architecture, Prentice Hall.
2. William Stallings (2015), COArchitecture Designing for Performance, Pearson.
3. John P Hayes (1998), Computer Architecture and Organization, Tata McGraw Hill.
4. Bartee, T.C. (2001), Digital Computer Fundamentals, MC Graw Hill.
5. Mathur A.P. (1995), Introduction to Microprocessors, Tata Mc Graw Hill.

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|                                                                                                                      |                                                                                                                                   | 2024-25                                            |

## COURSE CONTENT/SYLLABUS

### SEMESTER- III

| <b>Data Structures</b>              |                   |                              |             |
|-------------------------------------|-------------------|------------------------------|-------------|
| <b>Semester:</b>                    | <b>III</b>        | <b>Internal Assessment</b>   | <b>40</b>   |
| <b>Course Code:</b>                 | <b>UAITC30202</b> | <b>End Sem. Exam</b>         | <b>60</b>   |
| <b>Teaching Hours/Week (L:T:P):</b> | <b>3:1:0</b>      | <b>Exam Duration (Hours)</b> | <b>2.30</b> |
| <b>Credits: 4</b>                   |                   |                              |             |

#### PREREQUISITE(S)

- The students should hold fundamental knowledge of Computers.
- The students should hold the skill set of knowledge of programming in C.

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

- CO-1: Describe representation and functions of arrays. (Level 2: Understand)
- CO-2: Analyze an algorithm for searching and sorting techniques in terms of time complexity (Level 4: Analyze)
- CO-3: Use stacks, linear lists and queues. (Level 3: Apply)
- CO-4: Describe the Linked List (Level 2: Understand)
- CO-5: Demonstrate the data structure concepts using 'C' programming. (Level 3: Apply)

#### DETAILED SYLLABUS

##### UNIT-I

**Introduction:** Data Structures, Classifications (Primitive & Non-Primitive), Data structure operations (Traversing, inserting, deleting, searching, and sorting). Review of Arrays. Structures: Array of structures Self-Referential Structures. Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, dynamically allocated arrays and Multidimensional Arrays. Demonstration of representation of Polynomials and Sparse Matrices with arrays.

##### UNIT-II

**Stacks:** Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays. Different representation of expression. Stack Applications: Infix to postfix conversion, Infix to prefix conversion, evaluation of postfix expression, recursion.

**Queues:** Definition, Array Representation of Queues, Queue Operations, Circular Queues, Queues and Circular queues, Dequeues, Priority Queues.

##### UNIT-III

**Linked Lists:** Definition, classification of linked lists. Representation of different types of linked lists in Memory, Traversing, Insertion, Deletion, Searching, Sorting, and Concatenation Operations on Singly linked list, Doubly Linked lists, Circular linked lists, and header linked lists.

**Trees:** Terminologies, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Applications of Linked lists – Polynomials, Sparse matrix representation. Programming Example.

#### UNIT-IV

Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, and Searching operation on Binary search tree. Application of Trees-Evaluation of Expression.

**Graphs:** Definitions, Terminologies, Matrix and Adjacency List Representation of Graphs, Traversal methods: Breadth First Search and Depth First Search.

**Hashing:** Hash Table organizations, Hashing Functions, Static and Dynamic Hashing.

#### Reference Books

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.
3. Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012.
4. Gilberg and Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning, 2014.
5. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, 2nd Ed, McGraw Hill, 2013
6. A M Tenenbaum, Data Structures using C, PHI, 1989

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## COURSE CONTENT/SYLLABUS

### SEMESTER- III

| <b>Artificial Intelligence</b>      |                   |                              |             |
|-------------------------------------|-------------------|------------------------------|-------------|
| <b>Semester:</b>                    | <b>III</b>        | <b>Internal Assessment</b>   | <b>40</b>   |
| <b>Course Code:</b>                 | <b>UAITC30203</b> | <b>End Sem. Exam</b>         | <b>60</b>   |
| <b>Teaching Hours/Week (L:T:P):</b> | <b>3:1:0</b>      | <b>Exam Duration (Hours)</b> | <b>2.30</b> |
| <b>Credits: 4</b>                   |                   |                              |             |

#### PREREQUISITE(S)

- Students should have Basic knowledge of Statistics and modeling.
- Students should have knowledge of computers and programming.
- Students should have Analytical skills.

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

- CO-1: Explain the fundamentals of Artificial Intelligence. (Level 2 Understand)
- CO-2: Explain the Uninformed Searching and informed searching algorithms. (Level 2 Understand)
- CO-3: Describe Knowledge representation. (Level 2 Understand)
- CO-4: Solve the Gaming problems. (Level 4 Analyze)
- CO-5: Formulate valid solutions for problems involving uncertain inputs or outcomes by using decision making techniques.(Level 3 Apply)

#### DETAILED SYLLABUS

##### UNIT-I

**Introduction to Artificial Intelligence:** History of Artificial Intelligence, What is AI, Intelligent Agents: Agents and Environments, Rationality, nature of the environment, the structure of Agents. Problem-solving: Problem-solving agents, Example problems, Searching for solutions

##### UNIT-II

**Uninformed Search Strategies:** Breadth-first Search, Uniform cost search, Depth-first search, Depth limited search, Iterative deepening depth-first search, Bidirectional search, Comparing uninformed Search strategies, Informed search strategies: Greedy best-first search, A\* Search, AO\* Search, Heuristic Function

##### UNIT-III

**Constraint Satisfaction Problems:** Defining Constraint Satisfaction Problems, Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems Knowledge, reasoning: Knowledge-based Agents, The Wumpus World, Logic, Propositional Logic, propositional Theorem Proving, Effective Propositional Model checking, agents based on Propositional logic.

## UNIT-IV

**First Order Logic:** Representation, Syntax and semantics of FOL, Using First order Logic, Knowledge Engineering in first-order logic. Inference in First-Order Logic: Propositional vs. First-Order Inference and Lifting, Forward Chaining, Backward Chaining, Resolution . Expert systems: Introduction, basic concepts, structure of expert systems

### Reference Books

1. S. Russel and P. Norvig, “Artificial Intelligence– A Modern Approach”, Second Edition, Pearson Education
2. David Poole, Alan Mackworth, Randy Goebel, ”Computational Intelligence : a logical approach”, Oxford University Press.
3. G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem solving”, Fourth Edition, Pearson Education.
4. J. Nilsson, “Artificial Intelligence: A new Synthesis”, Elsevier Publishers

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|                                                                                                                      |                                                                                                                                   | 2024-25                                            |

## COURSE CONTENT/SYLLABUS

### SEMESTER- III

| <b>Python Programming</b>           |                   |                              |             |
|-------------------------------------|-------------------|------------------------------|-------------|
| <b>Semester:</b>                    | <b>III</b>        | <b>Internal Assessment</b>   | <b>40</b>   |
| <b>Course Code:</b>                 | <b>UAICC30200</b> | <b>End Sem. Exam</b>         | <b>60</b>   |
| <b>Teaching Hours/Week (L:T:P):</b> | <b>3:0:2</b>      | <b>Exam Duration (Hours)</b> | <b>2.30</b> |
| <b>Credits: 4</b>                   |                   |                              |             |

### PREREQUISITE(S)

Students should have knowledge of computers and programming.

### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

- CO-1: Explain the fundamentals of python programming. (Level 2 Understand)
- CO-2: Explain the basic principles of functions and modules. (Level 2 Understand)
- CO-3: Describe files handling and exception handling. (Level 2 Understand)
- CO-4: Identify and fix common errors in Python programs. (Level 4 Analyze)
- CO-5: Write codes in Python to solve mathematical or real world problems. (Level 3 Apply)

### DETAILED SYLLABUS

#### UNIT-I

**Introduction to Python Language:** History of Python, What is Python mainly used for?, Strengths and Weaknesses, IDLE, Dynamic Types, Naming Conventions.

**The Context of Software Development:** Software, Learning Programming with Python. Values and Variables-Integer and String Values-Identifiers-User Input-String Formatting, String Values, String Operations, String Slices, String Operators

#### UNIT-II

**Data Collections and Language Component:** Numeric Data Types, Conversions, Built-in Functions, Expressions and Arithmetic- Expressions, Arithmetic Examples.

**Control Flow and Syntax:** range() function Indenting, if Statement, If Else Statement, elif Statement, For Loops While Loops, Loop Control Statements.

#### UNIT-III

**List:** Creating List, Traversing through List, List Methods, User input for list

**Tuple:** Creating Tuple, Traversing through tuple, Tuple methods

**Set:** Creating set, Traversing through set, set Operations, User input for set.

**Dictionary :** Creating Dictionary, Traversing through Dictionary, Dictionary Methods, User input for Dictionary

## UNIT-IV

**Functions and Modules:** Introduction, Defining Your Own Functions, Parameters, Function Documentation, Keyword and Optional Parameters, Passing Collections to a Function, Variable Number of Arguments, Scope, Passing Functions to a Function, Lambda function.  
**Objects and Classes:** Classes in Python, Principles of Object Orientation, Creating Classes, Instance Methods. `__init__` method, Inheritance.

## List of Experiments

1. Write a Python code to implement the following
  - a. Calculate the probability of tossing a coin
  - b. Calculate the probability of throwing a dice
2. Write a python code to implement Matrix Operations
3. Write a python code to implement Vector Operations
4. Write a python code for data preprocessing
  - (a) Handling missing values
  - (b) Label encoding/ Onehotencoding
  - (c) Standardizing the features
  - (d) Train\_test\_split
  - (e) Handling Textual data(NLTK)
5. Write python code to implement Linear regression
6. Write python code to implement Logistic regression
7. Write a python code to implement Lasso and Ridge regression
8. Write a Python code to implement Support Vector Machine
9. Write a Python code to implement Multiple linear regression
10. Write a Python code to implement Gaussian distribution
11. Write a Python code to implement Multinomial
12. Write a Python code to implement Decision tree
13. Write a Python code to implement K-mean clustering
14. Write a Python code to implement agglomerative clustering
15. Write a Python code to implement Ada boosting as regression
16. Write a Python code to implement Ada boosting as classification
17. Write a Python code to implement Gradient boosting as regression
18. Write a Python code to implement Gradient boosting as classification

## Reference Books

1. Charles Dierbach (2015), Introduction to Computer Science using Python, Wiley, 1st Edition ISBN-10: 81265560132015
2. John Zelle (2010), Python Programming: An Introduction to Computer Science, 2nd Edition.
3. Zed A. Shaw (2017), Learn Python the Hard Way Paperback, Pearson Education, 3rd Edition ISBN-10: 9332582106.
4. Felix Alvaro, PYTHON, Easy Python Programming for Beginners, Your Step-By-Step Guide to Learning Python Programming.
5. Paul Barry (2010), Head First Python, O' Reilly Publishers, 1st Edition, ISBN: 1449382673.

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|                                                                                                                      |                                                                                                                                   | 2024-25                                            |

## COURSE CONTENT/SYLLABUS

### SEMESTER- III

| Universal Human Values              |                   |                              |           |
|-------------------------------------|-------------------|------------------------------|-----------|
| <b>Semester:</b>                    | <b>III</b>        | <b>Internal Assessment</b>   | <b>20</b> |
| <b>Course Code:</b>                 | <b>UAICA30200</b> | <b>End Sem. Exam</b>         | <b>30</b> |
| <b>Teaching Hours/Week (L:T:P):</b> | <b>2:0:0</b>      | <b>Exam Duration (Hours)</b> | <b>2</b>  |
| <b>Credits: 2</b>                   |                   |                              |           |

#### PREREQUISITE(S)

None

#### COURSE OUTCOMES

By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).

It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction. Therefore, the course and further follow up is expected to positively impact common graduate attributes like:

1. Holistic vision of life
2. Socially responsible behavior
3. Environmentally responsible work
4. Ethical human conduct
5. Having Competence and Capabilities for Maintaining Health and Hygiene
6. Appreciation and aspiration for excellence (merit) and gratitude for all This is only an introductory foundational input.

It would be desirable to follow it up by

- a) Faculty-student or mentor-mentee programs throughout their time with the institution
- b) Higher level courses on human values in every aspect of living

#### DETAILED SYLLABUS

#### UNIT-I

##### Introduction to Value Education

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Lecture 2: Understanding Value Education

Tutorial 1: Practice Session PS1 Sharing about Oneself

Lecture 3: Self-exploration as the Process for Value Education

Lecture 4: Continuous Happiness and Prosperity – the Basic Human Aspirations

Tutorial 2: Practice Session PS2 Exploring Human Consciousness

Lecture 5: Happiness and Prosperity – Current Scenario  
Lecture 6: Method to Fulfill the Basic Human Aspirations  
Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

## UNIT-II

### **Harmony in the Human Being**

Lecture 7: Understanding Human being as the Co-existence of the Self and the Body  
Lecture 8: Distinguishing between the Needs of the Self and the Body  
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of Self and Body  
Lecture 9: The Body as an Instrument of the Self  
Lecture 10: Understanding Harmony in the Self  
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the Self  
Lecture 11: Harmony of the Self with the Body  
Lecture 12: Programme to ensure self-regulation and Health  
Tutorial 6: Practice Session PS6 Exploring Harmony of Self with the Body

## UNIT-III

### **Harmony in the Family and Society**

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction  
Lecture 14: 'Trust' – the Foundational Value in Relationship  
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust  
Lecture 15: 'Respect' – as the Right Evaluation  
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect  
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship  
Lecture 17: Understanding Harmony in the Society  
Lecture 18: Vision for the Universal Human Order  
Tutorial 9: Practice Session PS9 Exploring Systems to fulfill Human Goal

## UNIT-IV

### **Harmony in the Nature/Existence**

Lecture 19: Understanding Harmony in the Nature  
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature  
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature  
Lecture 21: Realizing Existence as Co-existence at All Levels  
Lecture 22: The Holistic Perception of Harmony in Existence  
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence

### **Implications of the Holistic Understanding – a Look at Professional Ethics**

Lecture 23: Natural Acceptance of Human Values  
Lecture 24: Definitiveness of (Ethical) Human Conduct  
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct  
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order  
Lecture 26: Competence in Professional Ethics  
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education  
Lecture 27: Holistic Technologies, Production Systems and Management Models Typical Case Studies  
Lecture 28: Strategies for Transition towards Value-based Life and Profession  
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

## Reference Books

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English) 13. Gandhi - Romain Rolland (English)

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|                                                                                                                      |                                                                                                                                   | 2024-25                                            |

## COURSE CONTENT/SYLLABUS

### SEMESTER- III

| Lab on Data Structures              |                   |                              |           |
|-------------------------------------|-------------------|------------------------------|-----------|
| <b>Semester:</b>                    | <b>III</b>        | <b>Internal Assessment</b>   | <b>20</b> |
| <b>Course Code:</b>                 | <b>UAIPC30200</b> | <b>End Sem. Exam</b>         | <b>30</b> |
| <b>Teaching Hours/Week (L:T:P):</b> | <b>0:0:4</b>      | <b>Exam Duration (Hours)</b> | <b>2</b>  |
| <b>Credits: 2</b>                   |                   |                              |           |

### PREREQUISITE(S)

None

### COURSE OUTCOMES

- CO-1: The students should be able to describe and implement various data structures including lists, arrays, stacks, queues, binary search trees, graphs, hash tables, and matrices.
- CO-2: The student will be able to analyze and apply various algorithms for shortest path calculation, sorting and searching applications

### LABORATORY PROGRAMS

#### PART-A

1. Write a c program to perform merging of two array.
2. Write a c program to insert array element at user specified position.
3. Write a c program to remove an array element from position.
4. Write a c program to perform Matrix Addition and Matrix Subtraction.
5. Write a c program to perform Matrix Multiplication.
6. Write a c program to perform Linear Search.
7. Write a c program to perform Binary Search.
8. Write a c program to perform bubble sort.
9. Write a c program to perform quick sort.
10. Write a c program to perform merge sort.
11. Write a c program to perform Stack Implementation using array.
12. Write a c program to perform Stack Implementation using a linked list.
13. Write a c program to reverse a string using stack.
14. Write a c program for conversion of an expression from Infix to Prefix.
15. Write a c program for conversion of an expression from Infix to Postfix.

#### PART-B

1. Write a c program to evaluate prefix expression.
2. Write a c program to evaluate postfix expression.
3. Write a c program to implement a simple queue using linked list.

4. Write a c program to implement a circular queue using linked list.
5. Write a c program to implement De-queue using array.
6. Write a c program to implement a simple queue using an array.
7. Write a c program to implement a circular queue using an array.
8. Write a c program to implement singly linked list(insert at beginning and display the list)
9. Write a c program to implement singly linked list(insert at end and display the list).
10. Write a c program to implement singly linked list(insert at specified position and display the list).
11. Write a c program to implement singly linked list (insert at end and delete at end)
12. Write a c program to implement circular linked list (insert at specified position and display the list).
13. Write a c program to implement doubly linked list.
14. Write a c program to create binary tree and traverse the tree.

## COURSE ASSESSMENT

### I. Internal Assessment: 20 Marks

**Marks Distribution** (Subjected to change based on the decision of faculty in charge):

- IA + Preparation of lab manual = 15 +5 = 20 Marks
- One internal assessment (IA) of 15 marks will be conducted for each part (A & B) and average marks of two IA will be considered.
- Marks distribution for 15 marks IA in each part:  
Procedure + Execution +Viva = 3+9+3 = 15
- Remaining 5 marks will be given for writing lab manual consisting of Algorithm, Flowchart, Program and outputs for every experiment.

### II. End Semester Examination: 30 Marks

- Students are allowed to pick one program from PART-A and one program from PART-B and are given equal opportunity. So, students have to write and execute two programs in total.
- **Marks Distribution**
  - I. PART-A Experiment – Procedure + Execution +Viva = 3 + 9 +3 =15 Marks
  - II. PART-B Experiment – Procedure + Execution +Viva = 3 + 9 +3 =15 Marks

|                                                                                                                      |                                                                                                                                   |                                                    |
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|                                                                                                                      |                                                                                                                                   | 2024-25                                            |

## COURSE CONTENT/SYLLABUS

### SEMESTER- IV

| <b>Introduction to Machine Learning</b> |                   |                              |             |
|-----------------------------------------|-------------------|------------------------------|-------------|
| <b>Semester:</b>                        | <b>IV</b>         | <b>Internal Assessment</b>   | <b>40</b>   |
| <b>Course Code:</b>                     | <b>UAICC40201</b> | <b>End Sem. Exam</b>         | <b>60</b>   |
| <b>Teaching Hours/Week (L:T:P):</b>     | <b>3:0:2</b>      | <b>Exam Duration (Hours)</b> | <b>2.30</b> |
| <b>Credits: 4</b>                       |                   |                              |             |

#### PREREQUISITE(S)

- Students should have knowledge of basic mathematics.
- Students should have knowledge of computer programming.

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

- CO-1: Describe the different forms of learning (Level 1 Remember)
- CO-2: Use the provability theory in machine learning. (Level 3 Apply)
- CO-3: Examine the classification techniques on given datasets. (Level 4 Analyze)
- CO-4: Construct neural network model for machine learning. (Level 6 Create)
- CO-5: Design clustering algorithms to classify given sample in machine learning. (Level 6 Create)

#### DETAILED SYLLABUS

##### UNIT-I

Machine Learning, Applications of Machine Learning, processes involved in Machine Learning, Introduction to Machine Learning Techniques: Supervised Learning, Unsupervised Learning and Reinforcement Learning, Real life examples of Machine Learning. Data sets and Attribute types, Basic statistical descriptions of Data, Data Visualization, Measuring Data similarity and Dissimilarity.

##### UNIT-II

Data Preprocessing, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data discretization. Feature sets, Dataset division: test, train and validation sets, cross validation.

##### UNIT-III

Classification and Regression: K-Nearest Neighbor, Linear Regression, Logistic Regression, Support Vector Machine (SVM), Decision trees, Evaluation Measures: SSE, MME, R<sup>2</sup>, confusion matrix, precision, recall, F-Score, ROC-Curve.

## UNIT-IV

Introduction to clustering, Types of Clustering: Hierarchical, Agglomerative Clustering and Divisive clustering; Partitional Clustering - K-means clustering.

### List of Experiments

1. Mathematical computing with Python packages like: numpy, Mat- plotLib, pandas, Tensor Flow, Keras.
2. Data processing using Python packages.
3. Implement basic ML models like Decision trees, SVM, KNN, K-Means, Logistic Regression, and Linear Regression.

### Reference Books

1. Introduction to Machine Learning, By Jeeva Jose, Khanna Book Publishing Co., 2020.
2. Machine Learning for Dummies, By John Paul Mueller and Luca Massaron, For Dummies, 2016.
3. Machine Learning, By Rajeev Chopra, Khanna Book Publishing Co., 2021.
4. Machine Learning: The New AI, By Ethem Alpaydin, The MIT Press, 2016.

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|                                                                                                                      |                                                                                                                                   | B. Tech Course<br>Structure & Syllabus |
|                                                                                                                      |                                                                                                                                   | 2024-25                                |

## COURSE CONTENT/SYLLABUS

### SEMESTER- IV

| Design & Analysis of Algorithms (DAA) |            |                       |      |
|---------------------------------------|------------|-----------------------|------|
| Semester:                             | IV         | Internal Assessment   | 40   |
| Course Code:                          | UAITC40204 | End Sem. Exam         | 60   |
| Teaching Hours/Week (L:T:P):          | 3:1:0      | Exam Duration (Hours) | 2.30 |
| Credits: 4                            |            |                       |      |

#### PREREQUISITE(S)

- Students should have fundamental knowledge of programming and mathematics.
- Students should have knowledge of data structures.

#### COURSE OUTCOMES

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

- CO-1: Analyze the performance of the algorithms, state the efficiency using asymptotic notations and analyze mathematically the complexity of the algorithm.
- CO-2: Apply divide and conquer approaches and decrease and conquer approaches in solving the problems and analyze the same.
- CO-3: Apply the appropriate algorithmic design techniques like greedy method, transform and conquer approaches and compare the efficiency of algorithms to solve the given problem.
- CO-4: Apply and analyze dynamic programming approaches to solve problems and improve algorithm time efficiency by sacrificing space.
- CO-5: Apply and analyze backtracking and branch and bound methods, and describe P, NP and NP-Complete problems.

#### DETAILED SYLLABUS

#### UNIT-I

**Introduction:** Algorithm and its Properties. Algorithm Specification-using natural language, using Pseudo code convention, Fundamentals of Algorithmic Problem solving, Analysis Framework-Time efficiency and space efficiency, Worst-case, Best-case and Average case efficiency.

**Performance Analysis:** Estimating Space complexity and Time complexity of algorithms.

**Asymptotic Notations:** Big-Oh notation ( $O$ ), Omega notation ( $\Omega$ ), Theta notation ( $\Theta$ ) with examples, Basic efficiency classes, Mathematical analysis of Non-Recursive and Recursive Algorithms with Examples.

**Brute force design technique:** Selection sort, sequential search, string matching algorithm with complexity Analysis

## UNIT-II

**Divide and Conquer:** General method, Recurrence equation for divide and conquer, solving it using Master's theorem, Divide and Conquer algorithms: Binary search, Merge sort, Quick sort.

**Decrease and Conquer Approach:** Introduction, Insertion sort, Graph searching algorithms.

## UNIT-III

**Greedy Method:** General method,

**Minimum cost spanning trees:** Prim's Algorithm, Kruskal's Algorithm with performance analysis.

**Single source shortest paths:** Dijkstra's Algorithm.

**Transform and Conquer Approach:** Introduction, Heaps and Heap Sort.

## UNIT-IV

**Dynamic Programming:** General method with Examples,

**Transitive Closure:** Warshall's Algorithm.

**All Pairs Shortest Paths:** Floyd's Algorithm, Knapsack problem.

**Backtracking:** General method, solution using back tracking to N-Queens problem, Sum of subsets problem, **Branch and Bound:** Assignment Problem

**NP-Complete and NP-Hard problems:** Basic concepts, non- deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes.

## Reference Books

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin: 2nd Edition, 2009. Pearson.
2. Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd Edition, 2014, Universities Press.
3. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
4. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)

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|                                                                                                                      |                                                                                                                                   | 2024-25                                            |

## COURSE CONTENT/SYLLABUS

### SEMESTER- IV

| <b>Software Engineering Principles</b> |                   |                              |           |
|----------------------------------------|-------------------|------------------------------|-----------|
| <b>Semester:</b>                       | <b>IV</b>         | <b>Internal Assessment</b>   | <b>30</b> |
| <b>Course Code:</b>                    | <b>UAITC40205</b> | <b>End Sem. Exam</b>         | <b>45</b> |
| <b>Teaching Hours/Week (L:T:P):</b>    | <b>3:0:0</b>      | <b>Exam Duration (Hours)</b> | <b>2</b>  |
| <b>Credits: 3</b>                      |                   |                              |           |

#### PREREQUISITE(S)

Students should have knowledge of programming language and image processing techniques.

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

- CO-1: Explain the role of software. (Level 2 Understand)
- CO-2: Analyze the software process and project metrics. (Level 3 Apply)
- CO-3: Discuss software project planning, management and principles. (Level 2 Understand)
- CO-4: Use the software testing techniques and strategies. (Level 3 Apply)
- CO-5: Explain the software configuration management.(Level 2 Understand)

#### DETAILED SYLLABUS

##### UNIT-I

##### **Software Engineering Fundamentals & Process Models:**

Nature and Characteristics of Software, Software Engineering as a Layered Technology, Software Process Framework, Software Process Models: Waterfall Model, Prototyping Model, RAD Model, Spiral Model, Agile Model, Project Management Concepts: Management Spectrum, People, Product, Process, Project, W5HH Principle, Software Metrics and Measurement: Measures, Metric Indicators, Process and Project Metrics, Software Quality Metrics.

##### UNIT-II

##### **Software Project Planning & Requirements Engineering:**

Software Project Planning Objectives, Software Project Estimation Techniques, Decomposition Techniques and Empirical Estimation Models, Risk Analysis and Risk Management, Requirement Analysis and Communication Techniques, Analysis Principles, Software Prototyping and Specification, Analysis Modeling: Data Modeling, Functional Modeling, Behavioral Modeling, Data Dictionary.

##### UNIT-III

##### **Software Design, Testing & Quality Assurance :**

Software Design Process and Design Principles, Design Concepts and Methods, Architectural

Design and Interface Design, Procedural Design, Software Testing Fundamentals, Test Case Design, White Box Testing and Black Box Testing, Software Testing Strategies, Software Configuration Management, Software Quality Assurance (SQA), ISO 9001, ISO 9002, ISO 9003.

### Reference Books

1. Software Engineering, Fifth Edition, Roger - Pressman, McGraw Hill.
2. Software Engineering , I Sommerville, International Computer Science, Series
3. Object Oriented Modeling and Design, Rumbaugh. J., Blaha M., Premerlani W., Eddy F and Lorensen W.,PHI.
4. Software Engineering, Schooma, McGraw Hill
5. Object Oriented Design and Analysis, Booch, Benjamin / Cummings.

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## COURSE CONTENT/SYLLABUS

### SEMESTER- IV

| <b>Computer Networks</b>            |                   |                              |             |
|-------------------------------------|-------------------|------------------------------|-------------|
| <b>Semester:</b>                    | <b>IV</b>         | <b>Internal Assessment</b>   | <b>40</b>   |
| <b>Course Code:</b>                 | <b>UAICC40202</b> | <b>End Sem. Exam</b>         | <b>60</b>   |
| <b>Teaching Hours/Week (L:T:P):</b> | <b>3:0:2</b>      | <b>Exam Duration (Hours)</b> | <b>2.30</b> |
| <b>Credits: 4</b>                   |                   |                              |             |

#### PREREQUISITE(S)

- The students should hold basic knowledge of Computer Fundamentals.
- The students should hold the skill set of basic network concepts.

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

- CO-1: Summarize the concepts of physical layer and media (Level 5: Evaluate)
- CO-2: Experiment on analog transmission and applications. (Level 4: Analyze)
- CO-3: Prepare a Computer Network and establish internet connection. (Level 3: Apply)
- CO-4: Describe the basic concept of wireless network (Level 2: Understand)

#### DETAILED SYLLABUS

##### UNIT-I

**Physical Layer & Media:** Analog and Digital, Periodic analog signals, Digital signals, Transmission of Digital Signals, Transmission impairment, Data rate limits, performance. Digital Transmission: Digital-to-digital conversion, analog-to-digital conversion, transmission modes Parallel Transmission Serial Transmission Analog Transmission: Digital-to-analog conversion, Analog-to-analog conversion Bandwidth Utilization: Multiplexing & Spreading.

##### UNIT-II

**Transmission Media:** Guided media, unguided media, Circuit-switched networks: Circuit-Switched Networks, Datagram networks, virtual-circuit networks, Data Link Layer: Error Detection and Correction, Block Coding, Linear block codes, cyclic codes, Checksum.

##### UNIT-III

**Computer Networks and the Internet:** Internet, Protocol, Application Layer: Network application architecture, process communication, HTTP, File Transfer: FTP, Electronic Mail in the Internet, SMTP, DNS Transport Layer: Transport-Layer Services and Principles, Multiplexing and Demultiplexing Applications, Connectionless Transport: UDP, Principles of Reliable of Data Transfer, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control.

## UNIT-IV

**Network Layer and Routing:** Introduction and Network Service Model, virtual circuits and datagrams, router, Internet protocol (IP), Forwarding & Addressing in internet, Routing Algorithms, Routing in the internet, Broad & Multicast Routing.

Wireless Networks: Wireless Links & Networks characteristics, Wi-Fi, Cellular Internet Access, Mobile IP, Managing mobility in cellular networks.

### List of Experiments

1. Write a program for using TCP and UDP Sockets.
2. Write a simulation of sliding window protocols.
3. Write a simulation of Routing Protocols.
4. Configure given network topologies using any network simulator software.
5. Write programs for error detecting codes.
6. Write a program for Client Server Communication.

### Reference Books

1. Data Communications & Networking Fourth Edition, Behrouz A Forouzan
2. Computer Networking” Third Edition, James F. Kurose, Keith W. Ross

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## COURSE CONTENT/SYLLABUS

### SEMESTER- IV

| Operating Systems                   |                   |                              |           |
|-------------------------------------|-------------------|------------------------------|-----------|
| <b>Semester:</b>                    | <b>IV</b>         | <b>Internal Assessment</b>   | <b>30</b> |
| <b>Course Code:</b>                 | <b>UAITC40206</b> | <b>End Sem. Exam</b>         | <b>45</b> |
| <b>Teaching Hours/Week (L:T:P):</b> | <b>3:0:0</b>      | <b>Exam Duration (Hours)</b> | <b>2</b>  |
| <b>Credits: 3</b>                   |                   |                              |           |

#### PREREQUISITE(S)

- The students should hold basic knowledge of computer System.
- The students should have practical knowledge of working with computers.

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

- CO-1: Review the basic concepts of operating system. (Level 2: Understand)
- CO-2: Illustrate the examples on processor scheduling and deadlock Prevention. (Level 3: Apply)
- CO-3: Justify the demand paging concepts for the comparison of page replacement algorithms. (Level 5: Evaluate)
- CO-4: Describe the disk scheduling algorithms and its comparison in terms of performance. (Level 5: Evaluate)
- CO-5: Review the file system and its protection mechanism. (Level 2: Understand)

#### DETAILED SYLLABUS

##### UNIT-I

**Introduction to Operating Systems:** Operating system concepts, functions and services, types of operating systems, evolution of operating system, system calls, operating system structures, layered approach, microkernel architecture and virtual machines. Process Management: Process concept, process states, process control block, threads and multithreading, inter-process communication, CPU scheduling concepts and scheduling algorithms – FCFS, SJF and Round Robin.

##### UNIT-II

**Process Synchronization:** Critical section problem, semaphores, deadlocks, deadlock prevention and avoidance.

**Memory Management:** Memory management techniques, swapping, contiguous memory allocation, paging, segmentation, virtual memory, demand paging and page replacement algorithms – FIFO, Optimal and LRU.

### UNIT-III

**Disk Scheduling:** Disk structure, disk scheduling algorithms – FCFS, SSTF, SCAN and C-SCAN, RAID structure.

**File System:** File concepts, access methods, directory structures, file allocation methods and file protection mechanisms.

**Protection and Security:** Goals of protection, access matrix and basic operating system security concepts.

### Reference Books

1. J. Sliberschatz (2006), *Operating systems Concepts*, McGraw Hill.
2. Madnick, S.E. Donovan J.J. (1974), *Operating system*, McGraw Hill.
3. Brinch Hansen P (1973), *Operating system Principles*, PHI.
4. Milan Milenkovic (2001), *Operating systems*, McGraw Hill.
5. William Stallings (2018), *Operating system Internals and Design Principles*, Pearson.

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|                                                                                                                      |                                                                                                                                   | 2024-25                                            |

## COURSE CONTENT/SYLLABUS

### SEMESTER- IV

| Indian Constitution                 |                  |                              |   |
|-------------------------------------|------------------|------------------------------|---|
| <b>Semester:</b>                    | <b>IV</b>        | <b>Internal Assessment</b>   | - |
| <b>Course Code:</b>                 | <b>UATA40101</b> | <b>End Sem. Exam</b>         | - |
| <b>Teaching Hours/Week (L:T:P):</b> | <b>2:0:0</b>     | <b>Exam Duration (Hours)</b> | - |
| <b>Credits: 0</b>                   |                  |                              |   |

### PREREQUISITE(S)

None

### COURSE OUTCOMES

- CO 1: Describe historical background of the constitution making and its importance for building a democratic India.
- CO 2: Explain the functioning of three wings of the government i.e., executive, legislative and judiciary.
- CO 3: Explain the value of the fundamental rights and duties for becoming good citizen of India.
- CO 4: Analyze the decentralization of power between central, state and local self-government.
- CO 5: Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

### DETAILED SYLLABUS

#### UNIT-I

##### **The Constitution – Introduction**

- The History of the Making of the Indian Constitution
- Preamble and the Basic Structure, and its interpretation
- Fundamental Rights and Duties and their interpretation
- State Policy Principles

#### UNIT-II

##### **Union Government**

- Structure of the Indian Union
- President – Role and Power
- Prime Minister and Council of Ministers
- Lok Sabha and Rajya Sabha

#### UNIT-III

##### **State Government**

- Governor – Role and Power

- Chief Minister and Council of Ministers
- State Secretariat

## UNIT-IV

### **Local Administration**

- District Administration
- Municipal Corporation
- Zila Panchayat

### **Election Commission**

- Role and Functioning
- Chief Election Commissioner
- State Election Commission

## Reference Books

1. Rajeev Bhargava, Ethics and Politics of the Indian Constitution, Oxford University Press, New Delhi, 2008
2. B.L. Fadia, The Constitution of India, Sahitya Bhawan; New edition (2017)
3. DD Basu, Introduction to the Constitution of India, Lexis Nexis; Twenty-Third 2018 edition

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|                                                                                                                      |                                                                                                                                   | 2024-25                                            |

## COURSE CONTENT/SYLLABUS

### SEMESTER- IV

| <b>DAA Lab</b>                      |                   |                              |           |
|-------------------------------------|-------------------|------------------------------|-----------|
| <b>Semester:</b>                    | <b>IV</b>         | <b>Internal Assessment</b>   | <b>20</b> |
| <b>Course Code:</b>                 | <b>UAIPC40201</b> | <b>End Sem. Exam</b>         | <b>30</b> |
| <b>Teaching Hours/Week (L:T:P):</b> | <b>0:0:4</b>      | <b>Exam Duration (Hours)</b> | <b>2</b>  |
| <b>Credits: 2</b>                   |                   |                              |           |

#### PREREQUISITE(S)

None

#### COURSE OUTCOMES

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

- CO-1: Develop programs to solve computational problems using suitable algorithm design strategy.
- CO-2: Compare algorithm design strategies by developing equivalent programs and observing running times for analysis (Empirical).
- CO-3: Make use of suitable integrated development tools to develop programs
- CO-4: Choose appropriate algorithm design techniques to develop solution to the computational and complex problems.
- CO-5: Demonstrate and present the development of program, its execution and running time(s) and record the results/inferences

#### LABORATORY PROGRAMS

- Write a program to implement and find the time complexity of different sorting and searching techniques.
- Write a program to find minimum cost spanning tree.
- Write a program to implement travelling sales person problem.
- Write a program to find Longest Path in a Directed Acyclic Graph.
- Write a program for Shortest path with exactly k edges in a directed and weighted graph.
- Write a program to implement knapsack problem.
- Write a program to implement N-Queens and sum of subset problem.

#### COURSE ASSESSMENT

##### **A. Internal Assessment: 20 Marks**

**Marks Distribution** (Subjected to change based on the decision of faculty in charge):

- IA + Preparation of lab manual =  $15 + 5 = 20$  Marks
- One internal assessment (IA) of 15 marks will be conducted for each part (A & B) and average marks of two IA will be considered.
- Marks distribution for 15 marks IA in each part:  
Procedure + Execution + Viva =  $3 + 9 + 3 = 15$
- Remaining 5 marks will be given for writing lab manual consisting of Algorithm, Flowchart, Program and outputs for every experiment.

#### **B. End Semester Examination: 30 Marks**

- Students are allowed to pick one program from PART-A and one program from PART-B and are given equal opportunity. So, students have to write and execute two programs in total.
- **Marks Distribution**
  - I. PART-A Experiment – Procedure + Execution + Viva =  $3 + 9 + 3 = 15$  Marks
  - II. PART-B Experiment – Procedure + Execution + Viva =  $3 + 9 + 3 = 15$  Marks



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## School of Computer Science

Dept.: Computer Science

B. Tech. in Computer Science

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2024-25

### COURSE CONTENT/SYLLABUS

#### SEMESTER V

| Deep Learning               |   |              |                       |   |      |
|-----------------------------|---|--------------|-----------------------|---|------|
| Semester                    | : | V            | Internal Assessment   | : | 40   |
| Course Code                 | : | UAITC50300ss | End Sem. Exam         | : | 60   |
| Teaching Hours/Week (L:T:P) | : | 3:1:0        | Exam Duration (Hours) | : | 2:30 |
| Credits : 4                 |   |              |                       |   |      |

#### PREREQUISITES

Programming using Python, Data Structures, Machine Learning.

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

1. Explain neural networks, optimization methods and regularization techniques used in deep learning.
2. Apply convolutional neural networks for image classification and computer vision applications.
3. Analyze sequential data using recurrent neural networks and transformer-based models.
4. Apply advanced deep neural networks to analyze real world problems.

#### UNIT - I

15 Hrs

**Introduction to Deep Learning:** Introduction to Deep Learning, Artificial Neural Networks, Perceptron and Multi-layer Perceptron, Activation Functions, Backpropagation Algorithm, Gradient Descent Optimization, Overfitting and Regularization, Batch Normalization and Dropout

#### UNIT - II

15 Hrs

**Convolutional Neural Networks:** Introduction to Convolutional Neural Networks, Convolution and Pooling Operations, CNN Architectures: LeNet, AlexNet and VGGNet, Image Classification using CNN, Transfer Learning Basics, Introduction to Object Detection, Applications of CNN in Computer Vision

#### UNIT - III

15 Hrs

**Sequence Models and Deep Learning Architectures:** Recurrent Neural Networks (RNN), Long Short-Term Memory (LSTM) Networks, Gated Recurrent Units (GRU), Sequence Modeling Basics, Attention Mechanism, Introduction to Transformers, Applications in Text and Time-series Data.

#### UNIT - IV

15 Hrs

**Advanced Neural networks:** Transfer Learning – Transfer Learning Models – Generative Adversarial Network and their variants – Region based CNN – Fast RCNN - You Only Look Once – Single shot detector

Kadaganchi, Aland Road, Kalaburagi 585 367, Karnataka, India.

Website: [www.cuk.ac.in](http://www.cuk.ac.in)



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### TEXT BOOKS

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, *Deep Learning*, 1st Edition, MIT Press, 2016.
2. Francois Chollet, *Deep Learning with Python*, 2nd Edition, Manning Publications, 2021.

### REFERENCE BOOKS

1. Simon Haykin, *Neural Networks and Learning Machines*, 3rd Edition, Pearson Education, 2009.
2. Charu C. Aggarwal, *Neural Networks and Deep Learning*, 1st Edition, Springer, 2018.
3. Aston Zhang, Zachary C. Lipton, Mu Li and Alexander J. Smola, *Dive into Deep Learning*, 1st Edition, Cambridge University Press, 2023.
4. Andrew Ng, *Deep Learning Specialization*, Coursera, <https://www.coursera.org/specializations/deep-learning>.
5. Prof. Mitesh M. Khapra, *Deep Learning*, NPTEL, <https://nptel.ac.in/courses/106106184>.
6. Kirill Eremenko and Hadelin de Ponteves, *Deep Learning A-Z™: Hands-On Artificial Neural Networks*, Udemy, <https://www.udemy.com/course/deeplearning>.



# Central University of Karnataka

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## School of Computer Science

Dept.: Computer Science

B. Tech. in Computer Science

Syllabus

2024-25

CENTRAL UNIVERSITY OF KARNATAKA

### COURSE CONTENT/SYLLABUS

#### SEMESTER V

| Database Management Systems |   |            |                       |   |      |
|-----------------------------|---|------------|-----------------------|---|------|
| Semester                    | : | V          | Internal Assessment   | : | 40   |
| Course Code                 | : | UAICC50300 | End Sem. Exam         | : | 60   |
| Teaching Hours/Week (L:T:P) | : | 3:0:2      | Exam Duration (Hours) | : | 2:30 |
| Credits : 4                 |   |            |                       |   |      |

#### PREREQUISITES

Students should have the knowledge of data structures

Students should know the concept of the file-handling

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

1. Identify the difference between database systems from file systems and describe each in both function and benefit. (Level 1 Remember)
2. Model an application's data requirements using conceptual modeling tools like ER diagrams and design database schemas based on the conceptual model. (Level 4 Analyze)
3. Describe the concept of normalization theory for normalizing database. (Level 2 Understand)
4. Explain the relational data model. (Level 2 Understand)
5. Apply practical experience by designing and constructing data models using SQL. (Level 3 Apply)

#### UNIT - I

15 Hrs

**Databases and Users:** Introduction, File oriented approach, characteristics of Database approach, advantages of DBMS over File Processing System. Implications of database approach, when not to use a DBMS. Database System Concepts and Architecture: Data Models, Schemas and Instances, DBMS Architecture and Data Independence- the Three Schema Architecture, Data Independence, DBMS languages and interfaces, The Database System Environment, Classification of DBMS.

#### UNIT - II

15 Hrs

**ER-Model:** Entity Types, entity sets, attributes and keys, Relationships, Relationship types, Roles and constraints, Weak entities, ER Diagrams Naming Conventions and Design Issues, ER Diagram for company Database, Case Studies: Insurance policy management system, Library Management system. The Relational Data Model & Relational Constraints: Relational model concepts, Relational Constraints and Relational Database Schemas.

**Relational Algebra Operation:** Introduction, unary relational operation-select and project, Relation algebra operations from Set Theory-Union, intersection and minus operation, Cartesian product operation, Binary relational operations: Join and division, The Division operation.



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### UNIT - III

15 Hrs

**SQL Schema Definition, Constraints, Queries and Views:** SQL Data Definition and data types, specifying constraints in SQL, schema Change statement in SQL, basic queries in SQL, more complex SQL queries, INSERT, DELETE, AND UPDATE statements in SQL. Specifying constraints and assertions and triggers.

**Functional Dependencies and Normalization of Relational Databases:** Informal Design guidelines for Relation Schemas, functional dependencies, Normal Forms: 1NF, 2NF, 3NF AND BCNF, Multi valued Dependencies and fourth Normal Form, Join Dependencies and fifth Normal form.

### UNIT - IV

15 Hrs

**Introduction to Transaction Processing Concepts and Theories:** Introduction to transaction processing, transaction and system concepts, Desirable properties of transaction, characterizing schedules based on recoverability, and characterizing schedules based on serializability.

**Concurrency Control Techniques:** Lock based concurrency control, Deadlocks, implementation of locking, Multiversion concurrency control techniques, and validation concurrency control Techniques.

**Database Recovery Techniques:** Recovery concepts, recovery techniques based on Deferred update. Database security: Introduction to database security, discretionary access control, mandatory access control, and statistical database.

### List of Experiments Suggested:

1. Creation of database schema using DDL commands.
2. Implementation of DML commands: INSERT, UPDATE and DELETE.
3. Execution of SQL queries using SELECT, WHERE, ORDER BY and GROUP BY clauses.
4. Implementation of JOIN operations and nested queries.
5. Creation and manipulation of views and indexes.
6. Design of ER diagrams for real-world applications.
7. Normalization of database tables up to BCNF.
8. Development of PL/SQL procedures and functions.
9. Implementation of triggers and cursors.
10. Transaction management using COMMIT, ROLLBACK and SAVEPOINT.

### TEXT BOOKS

1. Ramez Elmasri and Shamkant B. Navathe, *Fundamentals of Database Systems*, 5th Edition, Pearson Education, 2007.
2. Thomas Connolly, Carolyn Begg and Anne Strachan, *Database Systems*, 2nd Edition, Addison Wesley, 1999.



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### REFERENCE BOOKS

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, *Database System Concepts*, 6th Edition, McGraw-Hill, 2012.
2. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, *Database Concepts*, 5th Edition, McGraw-Hill, 2005.
3. C. J. Date, *Introduction to Database Systems*, 8th Edition, Addison Wesley, 2003.
4. NPTEL, *Database Management Systems*, <https://nptel.ac.in/courses/106105175>.
5. Coursera, *Databases and SQL for Data Science*, <https://www.coursera.org/learn/sql-data-science>.
6. Udemy, *The Complete SQL Bootcamp*, <https://www.udemy.com/course/the-complete-sql-bootcamp>.



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### COURSE CONTENT/SYLLABUS

#### SEMESTER V

| Theory of Computation       |   |            |                       |   |      |
|-----------------------------|---|------------|-----------------------|---|------|
| Semester                    | : | V          | Internal Assessment   | : | 40   |
| Course Code                 | : | UAITC50301 | End Sem. Exam         | : | 60   |
| Teaching Hours/Week (L:T:P) | : | 3:1:0      | Exam Duration (Hours) | : | 2:30 |
| Credits : 4                 |   |            |                       |   |      |

#### PREREQUISITES

The students should hold knowledge of general computing and set theory.

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

1. Explain the concept of Automata theory and Turing machine. (Level 2: Understand)
2. Apply regular expression on real time problem. (Level 3: Apply)
3. Use Context-Free Grammars for the real time requirements. (Level 3: Apply)
4. Discuss on Normal forms. (Level 2: Understand)
5. Describe recursive enumerable approach for the real time problems. (Level 4: Evaluate)

#### UNIT - I

15 Hrs

**Introduction to Finite Automata:** Introduction to Finite Automata, the central concepts of Automata theory, deterministic finite automata, non-deterministic finite automata, equivalence NFA and DFA, Finite automata with Epsilon-transitions, conversion NFA with Epsilon-transitions to NFA, minimization of finite automata, finite automata with output, Moore and Melay machine.

#### UNIT - II

15 Hrs

**Regular Expressions and Languages:** Regular expression, equivalence Finite Automata and Regular Expressions, Closure properties of Regular languages, pumping lemma: proving languages not to be regular.

#### UNIT - III

15 Hrs

**Context-Free Grammars and Languages:** Type of grammar, Chomsky's hierarchy, derivation and its types, parsing, Parse trees, Ambiguity in grammars and removal techniques. Simplification of CFG: elimination of useless symbol, elimination of useless production, elimination of null production and unit production. Properties of Context-Free Languages: Normal forms for CFG: CNF and GNF, The pumping lemma for CFLs, Closure properties of CFLs. Regular grammar, conversion right linear to left linear and left liner to right linear regular grammar, equivalence of regular gramma and finite automata.



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### UNIT - IV

15 Hrs

**Pushdown Automata:** Definition of the Pushdown automata, the languages of a PDA, Instantaneous description, criteria of acceptance of the PDA, Equivalence of PDA's and CFG's, Non-deterministic Pushdown Automata. Introduction to Turing Machines: Turing machine model, design of Turing machine as input out device, to compute function, language acceptor, problems that computer cannot solve, programming techniques for Turing Machines, extensions to the basic Turing Machine, restricted Turing Machines.

### TEXT BOOKS

1. J. P. Hopcroft, Rajeev Motwani and J. D. Ullman, *Introduction to Automata Theory, Languages and Computation*, 2nd Edition, Pearson Education, 2001.
2. Kamala Krithivasan and Rama R., *Introduction to Formal Languages, Automata Theory and Computation*, Pearson Education, 2009.

### REFERENCE BOOKS

1. H. R. Lewis and Christos H. Papadimitriou, *Elements of the Theory of Computation*, PHI Learning, 1999.
2. John C. Martin, *Introduction to Languages and the Theory of Computation*, 3rd Edition, Tata McGraw-Hill, 1998.
3. Rajesh K. Shukla, *Theory of Computation*, Cengage Learning India Pvt. Ltd., 2009.
4. NPTEL, *Theory of Computation*, <https://nptel.ac.in/courses/106106049>.
5. Coursera, *Automata Theory*, <https://www.coursera.org/learn/automata-theory>.
6. Udemy, *Theory of Computation and Automata Theory*, <https://www.udemy.com/course/theory-of-computation-and-automata-theory>



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### COURSE CONTENT/SYLLABUS

### PROFESSIONAL ELECTIVE

| Statistical Thinking for Data Science |            |                       |      |
|---------------------------------------|------------|-----------------------|------|
| Professional Elective                 |            | Internal Assessment : | 40   |
| Course Code :                         | UAITL50400 | End Sem. Exam :       | 60   |
| Teaching Hours/Week (L:T:P)           | 3:1:0      | Exam Duration (Hours) | 2:30 |
| Credits : 4                           |            |                       |      |

### PREREQUISITES

Probability and Statistics, Linear Algebra, Python Programming, Basic Data Analysis Concepts.

### COURSE OUTCOMES

After completing this Course, the students should be able to:

1. Understand statistical foundations and probabilistic reasoning for data science.
2. Apply statistical techniques for data analysis and interpretation.
3. Analyze datasets using inferential and predictive statistical methods.
4. Evaluate statistical models and hypothesis testing techniques.
5. Develop data-driven solutions using statistical thinking.

#### UNIT - I

15 Hrs

**Introduction to Statistical Thinking:** Data Science Process, Types of Data, Descriptive Statistics, Measures of Central Tendency and Dispersion, Data Visualization Techniques, Exploratory Data Analysis (EDA), Correlation and Covariance.

#### UNIT - II

15 Hrs

**Probability and Distributions:** Basics of Probability, Conditional Probability, Bayes' Theorem, Random Variables, Probability Distributions, Binomial Distribution, Poisson Distribution, Normal Distribution, Sampling Techniques and Central Limit Theorem.

#### UNIT - III

15 Hrs

**Statistical Inference and Hypothesis Testing:** Estimation Techniques, Confidence Intervals, Hypothesis Testing, t-Test, Chi-Square Test, ANOVA, p-Values, Error Analysis, Statistical Significance.

#### UNIT - IV

15 Hrs

**Regression and Predictive Analytics:** Linear Regression, Multiple Regression, Logistic Regression, Model Assumptions, Model Evaluation Metrics, Feature Selection, Bias-Variance Tradeoff, Introduction to Time Series Analysis.



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### TEXT BOOKS

1. Trevor Hastie, Robert Tibshirani, and Jerome Friedman, The Elements of Statistical Learning, Springer, 2017.
2. Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani, An Introduction to Statistical Learning, Springer, 2021.
3. Allen B. Downey, Think Stats: Exploratory Data Analysis in Python, O'Reilly, 2014.

### REFERENCE BOOKS

1. Larry Wasserman, All of Statistics: A Concise Course in Statistical Inference, Springer, 2010
2. David Spiegelhalter, The Art of Statistics: Learning from Data, Basic Books, 2019.
3. Andreas C. Müller & Sarah Guido, Introduction to Machine Learning with Python, O'Reilly, 2016.
4. NPTEL Course: Probability and Statistics for Data Science.
5. Coursera Specialization: Statistics with Python.
6. Stanford Online: Statistical Learning.



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### COURSE CONTENT/SYLLABUS

#### PROFESSIONAL ELECTIVE

| Big Data Analytics            |            |                         |      |
|-------------------------------|------------|-------------------------|------|
| Professional Elective         |            | Internal Assessment :   | 40   |
| Course Code :                 | UAITL50401 | End Sem. Exam :         | 60   |
| Teaching Hours/Week (L:T:P) : | 3:1:0      | Exam Duration (Hours) : | 2:30 |
| Credits : 4                   |            |                         |      |

#### PREREQUISITES

Statistics and Data Analysis

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

1. Explain the concepts, characteristics and applications of big data analytics.
2. Analyze Hadoop architecture, HDFS and MapReduce processing techniques.
3. Explain the architecture and core components of the Apache Hive framework, including Hive modules, data types, and file formats.
4. Apply Spark APIs to create and manipulate Resilient Distributed Datasets (RDDs), perform RDD operations, and execute Spark jobs using lazy evaluation concepts.

#### UNIT - I

15 Hrs

**Fundamentals of Big Data:** Introduction to Big Data and Data Analytics, Characteristics and Challenges of Big Data, Big Data Applications and Case Studies, Fundamentals of Distributed File Systems, Difference between Traditional and Distributed File Systems, Overview of Big Data Technologies

#### UNIT - II

15 Hrs

**Hadoop Architecture and MapReduce:** Introduction to Hadoop Ecosystem, HDFS Architecture and Commands, HDFS Read and Write Operations, Introduction to MapReduce, Map and Reduce Phases, Shuffle and Sort, Introduction to YARN and its Architecture.

#### UNIT - III

15 Hrs

**Hive:** Introduction-Hive modules, Data types and file formats, Hive QL-Data Definition and Data Manipulation-Hive QL queries, Hive QL views- reduce query complexity. Hive scripts. Hive QL Indexes- Aggregate functions- Bucketing vs Partitioning.

#### UNIT - IV

15 Hrs

**Spark:** Overview of Spark – Hadoop Overview of Spark – Hadoop vs. Spark – Cluster Design – Cluster Management – performance, Application Programming interface (API): Spark Context, Resilient Distributed Datasets, Creating RDD, RDD Operations, and Saving RDD - Lazy Operation – Spark Jobs.



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### TEXT BOOKS

1. Tom White, *Hadoop: The Definitive Guide*, 4th Edition, O'Reilly Media, 2015.
2. Sridhar Alla, *Big Data Analytics with Hadoop 3*, 1st Edition, Packt Publishing, 2018.

### REFERENCE BOOKS

1. Subhashini Chellappan and Seema Acharya, *Big Data and Analytics*, 1st Edition, Wiley India, 2015.
2. Pramod J. Sadalage and Martin Fowler, *NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence*, 1st Edition, Addison-Wesley, 2012.
3. Paul Zikopoulos, Dirk deRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles and David Corrigan, *Harness the Power of Big Data: The IBM Big Data Platform*, 1st Edition, McGraw-Hill Education, 2012.
4. NPTEL, *Big Data Computing*, <https://nptel.ac.in/courses/106104189>.
5. Coursera, *Big Data Specialization*, <https://www.coursera.org/specializations/big-data>.
6. Udemy, *Apache Hadoop and Spark – Hands-on Big Data Analytics*, <https://www.udemy.com/course/apache-hadoop>



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### COURSE CONTENT/SYLLABUS

#### PROFESSIONAL ELECTIVE

| Image and Video Processing  |            |                       |      |
|-----------------------------|------------|-----------------------|------|
| Professional Elective       |            | Internal Assessment : | 40   |
| Course Code :               | UAITL50402 | End Sem. Exam :       | 60   |
| Teaching Hours/Week (L:T:P) | 3:1:0      | Exam Duration (Hours) | 2:30 |
| Credits : 4                 |            |                       |      |

#### PREREQUISITES

Linear Algebra, Probability and Statistics

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

1. Explain image formation, sampling, quantization and image enhancement techniques.
2. Apply segmentation, edge detection and feature extraction methods for image analysis.
3. Analyze video data using motion estimation, tracking and compression techniques.
4. Develop image and video processing solutions for real-world multimedia and computer vision applications.

#### UNIT - I

15 Hrs

**Fundamentals of Image Processing:** Introduction to Digital Image Processing, Applications of Digital Image Processing, Image Acquisition and Representation, Sampling and Quantization, Pixel Relationships, Gray Level Transformations, Histogram Processing, Spatial Domain Filtering, Fundamentals of Frequency Domain Processing, Image Enhancement Techniques

#### UNIT - II

15 Hrs

**Image Enhancement and Segmentation:** Image Enhancement in Spatial Domain, Frequency Domain Filtering, Image Restoration Basics, Edge Detection: Roberts, Sobel, Prewitt and Canny Operators, Image Segmentation: Thresholding and Region-based Segmentation, Morphological Operations, Feature Extraction and Shape Representation

#### UNIT - III

15 Hrs

**Video Processing and Compression:** Fundamentals of Video Processing, Video Representation and Video Signals, Motion Estimation Techniques, Optical Flow and Object Tracking, Video Enhancement and Denoising, Image Compression: JPEG, Video Compression: MPEG Standards, Video Processing Applications.

#### UNIT - IV

15 Hrs

**Pattern Recognition in Images and Videos:** Object Detection and Recognition, Face and Gesture Recognition, Multimedia Data Processing, Medical Image Processing, Remote Sensing Image



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Applications, Real-time Image and Video Processing Applications

### TEXT BOOKS

1. Rafael C. Gonzalez and Richard E. Woods, *Digital Image Processing*, 4th Edition, Pearson Education, 2018.
2. Anil K. Jain, *Fundamentals of Digital Image Processing*, 1st Edition, Pearson Education, 1989.

### REFERENCE BOOKS

1. S. Jayaraman, S. Esakkirajan and T. Veerakumar, *Digital Image Processing*, 1st Edition, McGraw-Hill Education, 2011.
2. Yao Wang, Joemedia and Aggelos K. Katsaggelos, *Video Processing and Communications*, 1st Edition, Prentice Hall, 2002.
3. A. Murat Tekalp, *Digital Video Processing*, 2nd Edition, Pearson Education, 2015.
4. NPTEL, *Digital Image Processing*, <https://nptel.ac.in/courses/117105079>.
5. Coursera, *Image and Video Processing: From Mars to Hollywood with a Stop at the Hospital*, <https://www.coursera.org/learn/image-processing>.
6. Udemy, *Mastering Computer Vision™ OpenCV4 in Python with Deep Learning*, <https://www.udemy.com/course/mastering-computer-vision-opencv-python>.



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### COURSE CONTENT/SYLLABUS

#### PROFESSIONAL ELECTIVE - SEMESTER V

| Bioinformatics              |            |                       |      |
|-----------------------------|------------|-----------------------|------|
| Professional Elective       |            | Internal Assessment : | 40   |
| Course Code :               | UAITL50403 | End Sem. Exam :       | 60   |
| Teaching Hours/Week (L:T:P) | 3:1:0      | Exam Duration (Hours) | 2:30 |
| Credits : 4                 |            |                       |      |

#### PREREQUISITES

Programming Fundamentals, Probability and Statistics, Database Management Systems, Basic Biology and Molecular Biology.

#### COURSE OUTCOMES

After completing this Course, the students should be able to:

1. Understand the fundamental concepts of bioinformatics and computational biology.
2. Apply computational methods for biological data analysis.
3. Analyze genomic, proteomic, and biological sequence data.
4. Evaluate bioinformatics algorithms and biological databases.
5. Design bioinformatics solutions for biological and healthcare applications.

#### UNIT - I

15 Hrs

**Introduction to Bioinformatics:** Fundamentals of Bioinformatics, Biological Databases, DNA, RNA and Protein Structures, Molecular Biology Basics, Sequence Data Formats, Biological Data Analysis, Bioinformatics Resources and Tools.

#### UNIT - II

15 Hrs

**Sequence Analysis and Computational Methods:** Pairwise and Multiple Sequence Alignment, Dynamic Programming, BLAST and FASTA Algorithms, Phylogenetic Analysis, Motif and Pattern Discovery, Sequence Similarity Search.

#### UNIT - III

15 Hrs

**Genomics and Proteomics:** Genome Sequencing Techniques, Genome Annotation, Transcriptomics, Proteomics, Protein Structure Prediction, Biomolecular Modelling, Functional Genomics.

#### UNIT - IV

15 Hrs

**Machine Learning and Data Analytics in Bioinformatics:** Data Mining in Bioinformatics, Machine Learning for Biological Data, Gene Expression Analysis, Classification and Clustering Techniques, Network Biology, Drug Discovery and Computational Drug Design.

**Applications and Case Studies in Bioinformatics:** Personalized Medicine, Healthcare Informatics, Systems Biology, AI in Bioinformatics, Big Data Analytics in Biology, Ethical Issues in Bioinformatics.



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### TEXT BOOKS

1. Arthur M. Lesk, Introduction to Bioinformatics, Oxford University Press, 2019.
2. Dan E. Krane and Michael L. Raymer, Fundamental Concepts of Bioinformatics, Pearson, 2006.
3. Pevsner Jonathan, Bioinformatics and Functional Genomics, Wiley-Blackwell, 2015.

### REFERENCE BOOKS

1. T. K. Attwood and D. J. Parry-Smith, Introduction to Bioinformatics, Pearson Education, 2014.
2. David W. Mount, Bioinformatics: Sequence and Genome Analysis, Cold Spring Harbor Laboratory Press, 2004.
3. Andreas D. Baxevanis and B. F. Francis Ouellette, Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Wiley, 2005.
4. NPTEL Course: Bioinformatics and Computational Biology.
5. Coursera Specialization: Genomic Data Science.
6. NCBI and EMBL Bioinformatics Resources.



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### COURSE CONTENT/SYLLABUS

#### PROFESSIONAL ELECTIVE

| Network Security and Cryptography |            |                       |  |      |
|-----------------------------------|------------|-----------------------|--|------|
| Professional Elective             |            | Internal Assessment : |  | 40   |
| Course Code :                     | UAITL50404 | End Sem. Exam :       |  | 60   |
| Teaching Hours/Week (L:T:P)       | 3:1:0      | Exam Duration (Hours) |  | 2:30 |
| Credits : 4                       |            |                       |  |      |

#### PREREQUISITES

Fundamentals of Computer Networks, Basic Knowledge of Discrete Mathematics and Number Theory, Operating Systems concepts

#### COURSE OUTCOMES

After completing this Course, the students should be able to:

1. Demonstrate the fundamentals of information security principles, security services, classical cryptography, and number theoretic concepts used in cryptographic systems.
2. Analyze symmetric key cryptographic algorithms and block cipher techniques for secure data communication.
3. Apply asymmetric cryptographic techniques, authentication mechanisms, digital signatures, and public key infrastructures for secure communication.
4. Evaluate network security protocols, cyber threats, intrusion detection techniques, firewalls, and real-world security applications.

#### UNIT - I

15 Hrs

**Fundamentals of Information Security and Classical Cryptography:** Need for Security – Security Approaches – Principles of Security – Types of Security Attacks – Security Services and Mechanisms – Network Security Model – Classical Encryption Techniques: Substitution Techniques, Transposition Techniques and Steganography

#### UNIT - II

15 Hrs

**Symmetric Key Cryptography and Block Ciphers:** Algebraic Structures – Congruence and Matrices – Block Cipher Principles and Operations – Simplified DES – Data Encryption Standard (DES) – Advanced Encryption Standard (AES) – Modes of Operation for Block Ciphers.

#### UNIT - III

15 Hrs

**Public Key Cryptography and Authentication Mechanisms:** Groups, Rings and Fields – Finite Fields – Principles of Public Key Cryptosystems – RSA Algorithm – ElGamal Cryptography – Diffie-Hellman Key Exchange – Elliptic Curve Cryptography – Message Authentication – SHA-3 – HMAC and CMAC – Digital Signatures – Kerberos – X.509 Authentication Service – Public Key Infrastructure (PKI).



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### UNIT - IV

15 Hrs

**Network Security, Threats and Applications:** Web Security Considerations – SSL and TLS – Secure Electronic Transactions – Email Security: PGP and S/MIME – Intruders and Intrusion Detection – Password Management – Viruses and Related Threats – Firewall Design Principles and Types of Firewalls – Case Studies: Secure Inter-branch Payment Transactions, Cross-site Scripting Vulnerability and Virtual Elections.

#### TEXT BOOKS

1. Cryptography and Network Security: Principles and Practice, William Stallings, *Cryptography and Network Security: Principles and Practice*, 8th Edition, 2022, Pearson.
2. Network Security Essentials: Applications and Standards, William Stallings, *Network Security Essentials: Applications and Standards*, 7th Edition, 2017, Pearson.

#### REFERENCE BOOKS

1. Cryptography and Network Security, Atul Kahate, *Cryptography and Network Security*, 4th Edition, 2019, McGraw Hill.
2. Computer Security: Principles and Practice, William Stallings and Lawrie Brown, *Computer Security: Principles and Practice*, 4th Edition, 2018, Pearson.
3. Applied Cryptography, Bruce Schneier, *Applied Cryptography: Protocols, Algorithms and Source Code in C*, 2nd Edition, 2015, John Wiley & Sons.
4. Cryptography and Network Security – NPTEL  
<http://nptel.ac.in/courses/106105162>
5. Introduction to Cyber Security – Coursera  
<http://www.coursera.org/learn/introduction-cyber-security>
6. Cryptography I – Coursera  
<http://www.coursera.org/learn/crypto>
7. OpenSSL Documentation  
<http://www.openssl.org/docs/>
8. OWASP Web Security Project  
<http://owasp.org/>



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### COURSE CONTENT/SYLLABUS

#### OPEN ELECTIVE

| Machine Learning with Python  |            |                         |      |
|-------------------------------|------------|-------------------------|------|
| Open Elective                 |            | Internal Assessment :   | 20   |
| Course Code :                 | UAICO50400 | End Sem. Exam :         | 30   |
| Teaching Hours/Week (L:T:P) : | 2:0:2      | Exam Duration (Hours) : | 1:30 |
| Credits : 3                   |            |                         |      |

#### PREREQUISITES

Machine Learning Basics, Python Programming

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

1. Explain machine learning concepts and Python libraries used for data analysis and preprocessing.
2. Apply supervised learning algorithms using Python for prediction and classification tasks.
3. Analyze datasets using clustering, dimensionality reduction and basic neural network techniques.

#### UNIT - I

15 Hrs

##### Python for Machine Learning and Supervised Learning:

Introduction to Machine Learning, Python Basics for Data Science, NumPy and Pandas, Data Preprocessing, Data Visualization, Feature Engineering, Training and Testing Data, Introduction to Scikit-learn, Linear Regression, Logistic Regression, k-Nearest Neighbour (k-NN), Decision Trees, Random Forest, Support Vector Machines (SVM), Model Evaluation and Cross Validation

#### UNIT - II

15 Hrs

##### Unsupervised Learning and Neural Networks:

Clustering using K-Means, Dimensionality Reduction using Principal Component Analysis (PCA), Introduction to Neural Networks, Basics of Deep Learning, Machine Learning Applications using Python, Model Development and Deployment Concepts.



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### List of Experiments Suggested:

1. Implementation of NumPy arrays and matrix operations.
2. Data preprocessing using Pandas library.
3. Data visualization using Matplotlib and Seaborn.
4. Implementation of Linear Regression using Scikit-learn.
5. Classification using Logistic Regression.
6. Implementation of k-Nearest Neighbour (k-NN) classifier.
7. Decision Tree classification using Python.
8. Clustering using K-Means algorithm.
9. Dimensionality reduction using Principal Component Analysis (PCA).
10. Simple neural network implementation using TensorFlow/Keras.

### TEXT BOOKS

1. Aurelien Géron, *Hands-On Machine Learning with Scikit-Learn, Keras and TensorFlow*, 3rd Edition, O'Reilly Media, 2022.
2. Andreas C. Müller and Sarah Guido, *Introduction to Machine Learning with Python*, 1st Edition, O'Reilly Media, 2016.

### REFERENCE BOOKS

1. Ethem Alpaydin, *Introduction to Machine Learning*, 4th Edition, MIT Press, 2021.
2. Sebastian Raschka and Vahid Mirjalili, *Python Machine Learning*, 3rd Edition, Packt Publishing, 2019.
3. Jake VanderPlas, *Python Data Science Handbook*, 1st Edition, O'Reilly Media, 2016.
4. NPTEL, *Introduction to Machine Learning*, <https://nptel.ac.in/courses/106106139>.
5. Coursera, *Machine Learning Specialization*, <https://www.coursera.org/specializations/machine-learning-introduction>.
6. Udemy, *Python for Data Science and Machine Learning Bootcamp*, <https://www.udemy.com/course/python-for-data-science-and-machine-learning-bootcamp>



# Central University of Karnataka

(Established by an Act of the Parliament in 2009)

## School of Computer Science

Dept.: Computer Science

B. Tech. in Computer Science

Syllabus

2024-25

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### COURSE CONTENT/SYLLABUS

#### OPEN ELECTIVE

| IOT                           |            |                         |      |
|-------------------------------|------------|-------------------------|------|
| Open Elective                 |            | Internal Assessment :   | 20   |
| Course Code :                 | UAICO50401 | End Sem. Exam :         | 30   |
| Teaching Hours/Week (L:T:P) : | 2:0:2      | Exam Duration (Hours) : | 1:30 |
| Credits : 3                   |            |                         |      |

#### PREREQUISITES

Computer Networks, Digital Electronics and Microprocessors

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

1. Explain the fundamentals, communication technologies and protocols used in IoT systems.
2. Develop basic IoT applications using sensors, embedded platforms and communication technologies.
3. Apply IoT resource management and Web of Things concepts in real-world applications.

#### UNIT - I

15 Hrs

##### Fundamentals of IoT and Communication Technologies:

Introduction and Characteristics of IoT, Challenges and Issues in IoT, Physical and Logical Design of IoT, IoT Functional Blocks, Communication Technologies: Bluetooth, Zigbee and Wi-Fi, IoT Protocols: MQTT and CoAP, Basics of Sensors and Actuators, RFID and Wireless Sensor Networks (WSN), IoT Deployment using Arduino/Raspberry Pi, Reading Sensor Data and Device Communication.

#### UNIT - II

15 Hrs

##### IoT Platforms, Applications and Web of Things:

Cloud Computing for IoT, Embedded Systems for IoT, M2M Communication, Resource Management in IoT, Introduction to Web of Things (WoT), IoT Data Management, REST APIs for IoT Applications, Smart Farming, Smart Buildings, Smart Retailing, Design and Development of IoT Applications.



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### List of Experiments Suggested:

1. Interfacing LED and push button with Arduino/Raspberry Pi.
2. Reading temperature and humidity sensor data using Arduino/Raspberry Pi.
3. Interfacing ultrasonic sensor for distance measurement applications.
4. Communication between IoT devices using Bluetooth module.
5. Wi-Fi based communication between IoT devices using ESP8266/NodeMCU.
6. Publishing and subscribing sensor data using MQTT protocol.
7. Implementation of RFID based access control system.
8. Monitoring sensor data using cloud platforms and REST APIs.
9. Simulation of IoT networks using Contiki OS and Cooja Simulator.
10. Development of simple IoT applications for smart farming or smart building systems.

### TEXT BOOKS

1. Arshdeep Bahga and Vijay Madisetti, *Internet of Things: A Hands-on Approach*, 1st Edition, Universities Press, 2014.
2. Raj Kamal, *Internet of Things: Architecture and Design Principles*, 1st Edition, McGraw-Hill Education, 2017.

### REFERENCE BOOKS

1. Vijay Madisetti and Arshdeep Bahga, *Internet of Things: Principles and Paradigms*, 1st Edition, CRC Press, 2014.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton and Jerome Henry, *IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things*, 1st Edition, Cisco Press, 2017
3. Srinivasa K. G., *Internet of Things*, 1st Edition, Cengage Learning, 2017.
4. NPTEL, *Introduction to Internet of Things*, <https://nptel.ac.in/courses/106105166>.
5. Coursera, *Introduction and Programming with IoT Boards*, <https://www.coursera.org/learn/introduction-to-iot>.
6. Udemy, *The Complete Internet of Things (IoT) Course*, <https://www.udemy.com/course/the-complete-internet-of-things-course>

1.

|                                                                                                                      |                                                                                                                                   |                                        |
|----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| <br>CENTRAL UNIVERSITY OF KARNATAKA | <b>Central University of Karnataka</b><br>(Established by an Act of the Parliament in 2009)<br><b>School of Computer Sciences</b> | Dept.: CS                              |
|                                                                                                                      |                                                                                                                                   | B. Tech Course<br>Structure & Syllabus |
|                                                                                                                      |                                                                                                                                   | 2024-25                                |

**COURSE**  
**CONTENT/SYLLABUS**  
**SEMESTER- V**

| <b>Lab on Deep Learning</b>         |                   |                              |           |
|-------------------------------------|-------------------|------------------------------|-----------|
| <b>Semester:</b>                    | <b>V</b>          | <b>Internal Assessment</b>   | <b>20</b> |
| <b>Course Code:</b>                 | <b>UAIPC50300</b> | <b>End Sem. Exam</b>         | <b>30</b> |
| <b>Teaching Hours/Week (L:T:P):</b> | <b>0:0:4</b>      | <b>Exam Duration (Hours)</b> | <b>2</b>  |
| <b>Credits: 2</b>                   |                   |                              |           |

**PREREQUISITE(S)**

Machine Learning, Python Programming.

**COURSE OUTCOMES**

After the completion of this course, students can able to:

1. The Students will understand and implement shallow and deep neural network architectures using Python, TensorFlow and Keras..
2. The student will be able to Develop convolutional, recurrent and transfer learning models for image and text processing applications.
3. The Students can apply deep learning techniques such as Auto Encoders, GANs and LSTM networks for real-world AI applications.

**LABORATORY PROGRAMS**

**PART A**

1. Demonstration of Google Colaboratory – Cloning GitHub repository, uploading datasets and basic file operations.
2. Implementation of Perceptron using Python.
3. Digit Classification using Neural Network on MNIST dataset.
4. Implementation of Multilayer Perceptron (BPN).
5. Implementation of Mini-batch Gradient Descent.
6. Classification of MNIST dataset using Convolutional Neural Network (CNN).
7. Face Recognition using CNN.

## PART B

1. Object Detection using Transfer Learning of CNN architectures.
2. Image Denoising using Auto Encoders on Iris dataset.
3. Handling Color Images using Stacked Auto Encoders.
4. Text Processing and Language Modeling using RNN.
5. Transfer Learning models for image classification problems.
6. Sentiment Analysis using LSTM.
7. Image Generation using Generative Adversarial Networks (GAN).

## COURSE ASSESSMENT

### I. Internal Assessment: 20 Marks

**Marks Distribution** (Subjected to change based on the decision of faculty in charge):

- IA + Preparation of lab manual = 15 + 5 = 20 Marks
- One internal assessment (IA) of 15 marks will be conducted for each part (A & B) and average marks of two IA will be considered.
- Marks distribution for 15 marks IA in each part: Procedure + Execution + Viva = 3+9+3 = 15
- Remaining 5 marks will be given for writing lab manual consisting of Algorithm, Flowchart, Program and outputs for every experiment.

### II. End Semester Examination: 30 Marks

- Students are allowed to pick one program from PART-A and one program from PART-B and are given equal opportunity. So, students have to write and execute two programs in total.
- **Marks Distribution**
  - I. PART-A Experiment – Procedure + Execution + Viva = 3 + 9 + 3 = 15 Marks
  - II. PART-B Experiment – Procedure + Execution + Viva = 3 + 9 + 3 = 15 Marks

|                                                                                                                      |                                                                                                                                                                                                           |                                  |
|----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
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|                                                                                                                      |                                                                                                                                                                                                           | B.Tech CS<br>Course<br>Structure |
|                                                                                                                      |                                                                                                                                                                                                           | 2024-25                          |

## COURSE CONTENT/SYLLABUS

### SEMESTER- V

| Mini Project                            |                   |                              |             |
|-----------------------------------------|-------------------|------------------------------|-------------|
| <b>Semester:</b>                        | <b>V</b>          | <b>Internal Assessment</b>   | <b>20</b>   |
| <b>Course Code:</b>                     | <b>UAIPR50300</b> | <b>End Sem. Exam</b>         | <b>30</b>   |
| <b>Teaching Hours/Week<br/>(L:T:P):</b> |                   | <b>Exam Duration (Hours)</b> | <b>2Hrs</b> |
| <b>Credits: 3</b>                       |                   |                              |             |

### PREREQUISITE(S)

Prerequisite Course / Knowledge (If any):

Students should have knowledge of programming language and software engineering

### Mini Project

Project work will be carried out either in the department. Each student shall carry out the project work individually/group (Max two members) and May publish the work done in the Conferences or journals. The students are required to submit a soft copy of the project report based on the work done by him/her during the project period. The project topics should be approved from the departmental panel. Students must submit a synopsis separately of more than one topic.

### Synopsis Template

The write up must adhere to the guidelines and should include the following:

- 1 Name / Title of the Project
- 2 Objective and scope of the Project
- 3 Introduction
- 4 Literature Survey
- 5 Proposed Methodology
- 6 Experimental Results and Discussion
- 7 Conclusions
- 8 Requirements (Hardware and Software)

**Guidelines for preparing the project Report:**

A4 size page should be used for typing, Left margin: 3.0cm Right margin: 2.0 cm, Top margin: 2.54 cm, Bottom margin: 2.54 cm, All pages as well as should be numbered at the bottom center of the pages. Normal Body Text: Font Size: 12, Times New Roman, Double Spacing, Justified. 6 point above, and below para spacing Paragraph Heading Font Size: 14, Times New Roman, Underlined, Left Aligned. 12 point above & below spacing. Chapter Heading Font Size: 20, Times New Roman, Center Aligned, 30 point above and below spacing. Coding Font size:10, Courier New, Normal

**Submission of Project Report**

Soft copy of the project report shall be submitted through the Moodle LMS course link provided by the internal project guide.



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### COURSE CONTENT/SYLLABUS

#### SEMESTER VI

| Advanced Machine Learning   |   |            |                       |   |      |
|-----------------------------|---|------------|-----------------------|---|------|
| Semester                    | : | VI         | Internal Assessment   | : | 25   |
| Course Code                 | : | UAICC60301 | End Sem. Exam         | : | 50   |
| Teaching Hours/Week (L:T:P) | : | 3:0:2      | Exam Duration (Hours) | : | 2:00 |
| Credits : 4                 |   |            |                       |   |      |

#### PREREQUISITES

Calculus, Differential Equations, Neural Networks , Deep Learning and Database Management Systems

#### COURSE OUTCOMES

After completing this Course, the students should be able to:

1. Demonstrate a solid foundation in advanced machine learning principles and applications.
2. Apply the concepts of kernel machines, including support vector machines (SVM) and multiple kernel learning.
3. Develop applications using Hidden Markov Models (HMMs).
4. Apply reinforcement learning and its key components to solve decision making problems.
5. Design and analyze applications using the latest techniques in machine learning.

#### UNIT - I

15 Hrs

#### Foundations of Advanced Machine Learning and Association Learning:

Examples of Machine Learning Applications, Classification, Regression, Unsupervised Learning, Reinforcement Learning Overview, Association Rule Mining, Apriori Algorithm, Performance Evaluation Concepts, Model Selection and Cross Validation.

#### UNIT - II

15 Hrs

#### Kernel Machines and Support Vector Learning:

Introduction to Kernel Machines, Optimal Separating Hyperplane, Soft Margin Hyperplane, Support Vector Machines (SVM), Kernel Trick, Vectorial Kernels, Defining Kernels, Multiple Kernel Learning, Multiclass Kernel Machines, Kernel Machines for Regression, One-Class Kernel Machines, Kernel Dimensionality Reduction.

#### UNIT - III

15 Hrs

#### Hidden Markov Models and Reinforcement Learning:

Discrete Markov Processes, Hidden Markov Models (HMMs), Three Basic Problems of HMMs, Evaluation Problem, Finding the State Sequence, Learning Model Parameters, Continuous Observations, HMM as a Graphical Model, Introduction to Reinforcement Learning, K-Armed Bandit Problem, Model-Based Learning, Value Iteration, Policy Iteration, Temporal Difference Learning, Exploration vs Exploitation, Applications of Reinforcement Learning.



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### List of Experiments Suggested:

1. Market Basket Analysis: Uncovering Association Rules in Retail Transactions Using the Apriori Algorithm.
2. Train and evaluate Decision Tree classifier (C4.5) using a real-world data.
3. Support Vector Machines for Binary Classification with Gaussian RBF Kernel.
4. Multiple Kernel Learning for Multiclass Classification.
5. Implement and evaluate a Hidden Markov Model (HMM) for the task of speech recognition.
6. Gesture Recognition Using Continuous Observations with Hidden Markov Models.
7. Explore the trade-off between exploration and exploitation in reinforcement learning using the K-Armed Bandit problem.
8. Model-Based Reinforcement Learning in a Stochastic Environment
9. Impact of Hyperparameter Tuning on Classifier Performance using K-Fold Cross-Validation.
10. Compare the performance metrics obtained through different resampling methods, specifically  $5 \times 2$  Cross-Validation and Bootstrapping.

### TEXT BOOKS

1. Tom M. Mitchell, Machine Learning , Tata McGraw Hill , 2017 ,978-1259096952.
2. Richard S. Sutton, Andrew G. Barto, Francis Bach, Reinforcement Learning: An Introduction, 2nd Edition, MIT Press, 2018  
978-0262039246.

### REFERENCE BOOKS

1. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, 3rd Edition, 2022.
2. Andreas Muller & Sarah Guido , Introduction to Machine Learning with Python: A Guide for Data Scientists,, 2016.
3. Dr. Balaraman Ravindran, Introduction to Machine Learning, ,<https://nptel.ac.in/courses/106106139>.
4. Reinforcement Learning Specialization, ,<https://www.coursera.org/specializations/reinforcement-learning>.
5. Leveraging Virtual Assistants for Personal Productivity, <https://www.coursera.org/learn/leveraging-virtual-assistants-for-personal-productivity>.
6. Generative Adversarial Networks (GANs) Specialization, <https://www.coursera.org/specializations/generative-adversarial-networks-gans>.
7. Artificial Intelligence: Reinforcement Learning in Python, <https://www.udemy.com/course/artificial-intelligence-reinforcement-learning-in-python>.



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### COURSE CONTENT/SYLLABUS

#### SEMESTER VI

| Data & Visual Analytics in AI |   |            |                       |   |      |
|-------------------------------|---|------------|-----------------------|---|------|
| Semester                      | : | VI         | Internal Assessment   | : | 25   |
| Course Code                   | : | UAICC60302 | End Sem. Exam         | : | 50   |
| Teaching Hours/Week (L:T:P)   | : | 3:0:2      | Exam Duration (Hours) | : | 2:00 |
| Credits : 4                   |   |            |                       |   |      |

#### PREREQUISITES

C Programming Fundamentals, Probability and Statistics, Database Management Systems, Python Programming, Basics of Machine Learning.

#### COURSE OUTCOMES

After completing this Course, the students should be able to:

1. Understand concepts of data analytics and visualization techniques.
2. Apply machine learning methods for predictive analytics.
3. Develop interactive dashboards and visual storytelling solutions.
4. Analyze AI-driven visual analytics techniques and graph-based systems.
5. Design AI-based analytics solutions for real-world applications.

#### UNIT - I

15 Hrs

##### Foundations of Data Analytics and Visualization:

Introduction to Data Analytics and Artificial Intelligence, Types of Data (Structured, Semi-Structured and Unstructured), Data Collection, Data Cleaning and Transformation, Exploratory Data Analysis (EDA), Descriptive Statistics, Principles of Data Visualization, Visualization Techniques (Bar Charts, Histograms, Scatter Plots, Heat Maps), Introduction to Visualization Tools: Matplotlib, Seaborn, Tableau and Power BI.

#### UNIT - II

15 Hrs

##### Machine Learning for Data Analytics:

Introduction to Predictive Analytics, Regression Techniques, Classification Techniques, Clustering Methods, Association Rule Mining, Principal Component Analysis (PCA), Model Evaluation Metrics (Accuracy, Precision, Recall, F1-Score), Explainable AI (XAI), AI-Assisted Data Exploration.

#### UNIT - III

15 Hrs

##### Visual Analytics, Dashboards and AI-Driven Analytics:

Visual Analytics Concepts and Frameworks, Interactive Data Visualization, Dashboard Design Principles, Storytelling with Data, Intelligent Dashboards, Network and Graph Visualization, Real-Time Data Visualization, Visualization using Plotly and Power BI/Tableau, Graph Analytics, Introduction to Graph Neural Networks, Natural Language Interfaces for Analytics, Generative AI for Data Visualization, Explainable Deep Learning Visualization, Ethics, Bias and Fairness in AI Analytics.



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### List of Experiments Suggested:

1. Exploratory Data Analysis using Python and Pandas.
2. Data Visualization using Matplotlib and Seaborn.
3. Interactive Dashboard Development using Tableau or Power BI.
4. Implementation of Regression and Classification Models.
5. Clustering Analysis using K-Means Algorithm.
6. Dimensionality Reduction using PCA.
7. Real-Time Data Visualization using Plotly.
8. Graph Analytics and Network Visualization.
9. Explainable AI Visualization Techniques.
10. Mini Project on AI-Driven Visual Analytics.

### TEXT BOOKS

1. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Introduction to Statistical Learning, Springer, 2021.
2. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition, O'Reilly, 2022.
3. Cole Nussbaumer Knaflitz, Storytelling with Data: A Data Visualization Guide for Business Professionals, Wiley, 2015.

### REFERENCE BOOKS

1. Andreas C. Müller & Sarah Guido, Introduction to Machine Learning with Python, O'Reilly, 2016.
2. Claus O. Wilke, Fundamentals of Data Visualization, O'Reilly, 2019.
3. Francois Chollet, Deep Learning with Python, Manning Publications, 2021.
4. NPTEL Course: Data Analytics with Python.
5. Coursera Specialization: Data Visualization with Tableau.
6. Coursera Specialization: AI for Everyone by Andrew Ng.



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### COURSE CONTENT/SYLLABUS

#### SEMESTER VI

| IOT                         |   |            |                       |   |      |
|-----------------------------|---|------------|-----------------------|---|------|
| Semester                    | : | VI         | Internal Assessment   | : | 40   |
| Course Code                 | : | UAITC60302 | End Sem. Exam         | : | 60   |
| Teaching Hours/Week (L:T:P) | : | 3:1:0      | Exam Duration (Hours) | : | 2:30 |
| Credits : 3                 |   |            |                       |   |      |

#### PREREQUISITES

Programming Fundamentals, Computer Networks, Basic Electronics, Operating Systems.

#### COURSE OUTCOMES

After completing this Course, the students should be able to:

1. Understand IoT architecture, enabling technologies, and communication protocols.
2. Design IoT systems using sensors, actuators, and embedded platforms.
3. Develop IoT applications using cloud, edge computing, and data analytics
4. Apply security, privacy, and interoperability techniques in IoT deployments.
5. Build real-world IoT solutions for smart cities, healthcare, agriculture, and industry.

#### UNIT - I

15 Hrs

**Introduction to IoT:** Evolution, IoT architecture, IoT ecosystem, sensors, actuators, embedded systems, Arduino/ESP32/Raspberry Pi overview, networking basics, IPv6, 6LoWPAN, MQTT, CoAP, REST APIs.

#### UNIT - II

15 Hrs

**IoT Communication and Device Programming:** Wireless technologies (Wi-Fi, BLE, ZigBee, LoRaWAN, NB-IoT), device interfacing, sensor data acquisition, edge computing basics, real-time data collection, firmware concepts.

#### UNIT - III

15 Hrs

**Cloud and Data Analytics for IoT:** IoT cloud platforms, data storage, stream processing, dashboards, IoT Analytics, AI/ML for IoT, digital twins, predictive maintenance, energy-efficient IoT.



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### TEXT BOOKS

1. Arshdeep Bahga & Vijay Madisetti, Internet of Things – A Hands-on Approach
2. David Hanes et al., IoT Fundamentals, Cisco Press.
3. Adrian McEwen & Hakim Cassimally, Designing the Internet of Things.

### REFERENCE BOOKS

1. Samuel Greengard, The Internet of Things, MIT Press.
2. Olivier Hersent et al., The Internet of Things: Key Applications and Protocols.
3. NPTEL: Internet of Things.



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### COURSE CONTENT/SYLLABUS

#### SEMESTER VI

| Natural Language Processing    |   |            |                          |   |      |
|--------------------------------|---|------------|--------------------------|---|------|
| Semester                       | : | VI         | Internal Assessment      | : | 25   |
| Course Code                    | : | UAICC60303 | End Sem. Exam            | : | 50   |
| Teaching Hours/Week<br>(L:T:P) | : | 3:0:2      | Exam Duration<br>(Hours) | : | 2:00 |
| Credits : 4                    |   |            |                          |   |      |

#### PREREQUISITES

Python Programming, Data Structures, Probability & Statistics, and Fundamentals of Machine Learning.

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

1. Explain lexical analysis, morphology and statistical language modeling techniques used in NLP.
2. Apply speech processing and parsing algorithms for syntactic analysis of natural language.
3. Analyze semantic relationships and lexical knowledge representations for language understanding tasks.
4. Develop NLP applications using machine translation, information retrieval and sentiment analysis techniques.

#### UNIT - I

15 Hrs

##### Foundations of NLP and Language Modeling:

Introduction to Natural Language Processing, Text Preprocessing, Lexical Analysis, Regular Expressions, Finite Automata for String Matching, Morphology Fundamentals, Parts-of-Speech Tagging, N-gram Language Models, Hidden Markov Models (HMMs), Introduction to Statistical Language Modeling.

#### UNIT - II

15 Hrs

##### Syntactic and Semantic Analysis:

Speech Processing Fundamentals, HMM-based Speech Recognition, Parsing Concepts and Parsing Algorithms, Dependency Parsing, WordNet and Lexical Knowledge Networks, Semantic Roles, Word Sense Disambiguation, Named Entity Recognition (NER), Conditional Random Fields (CRFs), Coreference Resolution.

#### UNIT - III

15 Hrs

##### NLP Applications and Modern Techniques:

Sentiment Analysis, Machine Translation, Information Retrieval, Information Extraction, Question Answering Systems, Text Summarization, Cross-Lingual Information Retrieval, Introduction to Transformer-based NLP Models and Applications.



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### List of Experiments Suggested:

1. Text preprocessing using tokenization, stemming and lemmatization.
2. Implementation of regular expressions for pattern matching.
3. Parts-of-Speech tagging using NLTK/spaCy.
4. Named Entity Recognition using NLP libraries.
5. Implementation of N-gram language models.
6. Sentiment analysis on text datasets.
7. Word sense disambiguation using WordNet.
8. Text classification using machine learning techniques.
9. Text summarization using extractive methods.
10. Parsing and syntax tree generation for sentences.

### TEXT BOOKS

1. Daniel Jurafsky and James H. Martin, *Speech and Language Processing*, 3rd Edition, Pearson Education, 2023.
2. Steven Bird, Ewan Klein and Edward Loper, *Natural Language Processing with Python*, 1st Edition, O'Reilly Media, 2009.

### REFERENCE BOOKS

1. Christopher D. Manning and Hinrich Schütze, *Foundations of Statistical Natural Language Processing*, 1st Edition, MIT Press, 1999.
2. Jacob Eisenstein, *Introduction to Natural Language Processing*, 1st Edition, MIT Press, 2019.
3. Yoav Goldberg, *Neural Network Methods for Natural Language Processing*, 1st Edition, Morgan & Claypool Publishers, 2017.
4. Christopher Manning, *Natural Language Processing with Deep Learning*, Stanford University, <https://web.stanford.edu/class/cs224n>.
5. NPTEL, *Natural Language Processing*, <https://nptel.ac.in/courses/106105158>.
6. Coursera, *Natural Language Processing Specialization*, <https://www.coursera.org/specializations/natural-language-processing>.



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### COURSE CONTENT/SYLLABUS

#### PROFESSIONAL ELECTIVE

| Machine Learning for Data Science |            |                         |      |
|-----------------------------------|------------|-------------------------|------|
| Professional Elective             |            | Internal Assessment :   | 40   |
| Course Code :                     | UAITL60405 | End Sem. Exam :         | 60   |
| Teaching Hours/Week (L:T:P) :     | 3:1:0      | Exam Duration (Hours) : | 2:30 |
| Credits : 4                       |            |                         |      |

#### PREREQUISITES

Linear Algebra, Data Analytics, Artificial Intelligence Basics

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

1. Explain the fundamentals of machine learning and data preprocessing techniques.
2. Apply supervised learning algorithms for classification and prediction problems.
3. Analyze datasets using clustering and dimensionality reduction techniques.
4. Develop basic machine learning solutions using neural networks for real-world data science applications.

#### UNIT - I

15 Hrs

**Fundamentals of Machine Learning and Data Preprocessing:** Introduction to Pattern Recognition and Visual Recognition, Pattern Recognition Systems and Applications, Feature Extraction and Feature Selection, Decision Theory and Bayesian Decision Theory, Statistical Pattern Recognition, Distance Measures and Similarity Metrics, Supervised and Unsupervised Learning Basics

#### UNIT - II

15 Hrs

**Supervised Learning Techniques:** Linear Regression and Logistic Regression, k-Nearest Neighbour (k-NN), Decision Trees and Random Forest, Support Vector Machines (SVM), Naïve Bayes Classifier, Ensemble Learning Basics, Model Evaluation Metrics and Cross Validation.

#### UNIT - III

15 Hrs

**Unsupervised Learning and Dimensionality Reduction:** Clustering Techniques: K-Means and Hierarchical Clustering, Association Rule Mining, Principal Component Analysis (PCA), Dimensionality Reduction Techniques, Anomaly Detection Basics, Recommendation Systems, Applications of Unsupervised Learning in Data Science

#### UNIT - IV

15 Hrs

**Neural Networks and Machine Learning Applications:** Introduction to Neural Networks, Perceptron and Multi-layer Perceptron, Deep Learning Basics, Introduction to Reinforcement Learning, Machine Learning for Text and Image Data, Ethical Issues in Machine Learning, Case

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Studies in Healthcare, Finance and Business Analytics.

### TEXT BOOKS

1. Aurelien Géron, *Hands-On Machine Learning with Scikit-Learn, Keras and TensorFlow*, 3rd Edition, O'Reilly Media, 2022.
2. Christopher M. Bishop, *Pattern Recognition and Machine Learning*, 1st Edition, Springer, 2006.

### REFERENCE BOOKS

1. Ethem Alpaydin, *Introduction to Machine Learning*, 4th Edition, MIT Press, 2021.
2. Tom M. Mitchell, *Machine Learning*, 1st Edition, McGraw-Hill Education, 1997.
3. Andreas C. Müller and Sarah Guido, *Introduction to Machine Learning with Python*, 1st Edition, O'Reilly Media, 2016.
4. NPTEL, *Introduction to Machine Learning*, <https://nptel.ac.in/courses/106106139>.
5. Coursera, *Machine Learning Specialization*, <https://www.coursera.org/specializations/machine-learning-introduction>.
6. Udemy, *Machine Learning A-Z™: Hands-On Python and R in Data Science*, <https://www.udemy.com/course/machinelearning>.



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### COURSE CONTENT/SYLLABUS

#### PROFESSIONAL ELECTIVE – SEMESTER VI

| Predictive Analytics          |            |                         |      |
|-------------------------------|------------|-------------------------|------|
| Professional Elective         |            | Internal Assessment :   | 40   |
| Course Code :                 | UAITL60406 | End Sem. Exam :         | 60   |
| Teaching Hours/Week (L:T:P) : | 3:1:0      | Exam Duration (Hours) : | 2:30 |
| Credits : 4                   |            |                         |      |

#### PREREQUISITES

Probability and Statistics, Python/R Programming, Data Structures, Fundamentals of Machine Learning and Data Science.

#### COURSE OUTCOMES

After completing this Course, the students should be able to:

1. Understand the concepts and importance of predictive analytics.
2. Apply statistical and machine learning techniques for predictive modeling.
3. Analyze datasets using regression, classification, and forecasting methods.
4. Evaluate predictive models using suitable performance metrics.
5. Design predictive analytics solutions for real-world applications.

#### UNIT - I

15 Hrs

**Introduction to Predictive Analytics:** Fundamentals of Predictive Analytics, Data Analytics Lifecycle, Data Collection and Preprocessing, Exploratory Data Analysis, Statistical Foundations, Correlation and Covariance, Data Visualization.

#### UNIT - II

15 Hrs

**Regression and Classification Techniques:** Linear Regression, Logistic Regression, Decision Trees, Naïve Bayes Classification, k-Nearest Neighbors, Support Vector Machines, Model Training and Validation.

#### UNIT - III

15 Hrs

**Forecasting and Time Series Analysis:** Time Series Components, Moving Average and Exponential Smoothing, ARIMA Models, Trend and Seasonal Analysis, Forecasting Accuracy Metrics, Predictive Modeling using Python/R.

#### UNIT - IV

15 Hrs

**Advanced Predictive Analytics:** Clustering Techniques, Association Rule Mining, Ensemble Learning, Random Forest and Boosting, Big Data Analytics, Predictive Analytics using Hadoop and Spark.

**Applications and Case Studies:** Predictive Analytics in Finance, Healthcare, Business Intelligence, Social Media Analytics, Fraud Detection, Customer Relationship Management.



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### TEXT BOOKS

1. Max Kuhn and Kjell Johnson, Applied Predictive Modeling, Springer, 2013.
2. Eric Siegel, Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die, Wiley, 2016.
3. Trevor Hastie, Robert Tibshirani, and Jerome Friedman, The Elements of Statistical Learning, Springer, 2017.

### REFERENCE BOOKS

1. Thomas W. Miller, Modeling Techniques in Predictive Analytics with Python and R, Pearson, 2015.
2. Mohammed J. Zaki and Wagner Meira Jr., Data Mining and Analysis, Cambridge University Press, 2014.
3. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly, 2022.
4. NPTEL Course: Data Analytics with Python.
5. Coursera Specialization: Predictive Analytics and Data Mining.



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### COURSE CONTENT/SYLLABUS

#### PROFESSIONAL ELECTIVE

| Deep Learning for Computer Vision |            |                       |      |
|-----------------------------------|------------|-----------------------|------|
| Professional Elective             |            | Internal Assessment : | 40   |
| Course Code :                     | UAITL60407 | End Sem. Exam :       | 60   |
| Teaching Hours/Week (L:T:P)       | 3:1:0      | Exam Duration (Hours) | 2:30 |
| Credits : 4                       |            |                       |      |

#### PREREQUISITES

Deep learning Basics, Machine Learning Fundamentals

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

1. Explain the fundamental concepts of deep learning, neural networks, backpropagation, optimization techniques, and CNN basics for computer vision applications.
2. Analyze and implement convolutional neural network architectures, regularization methods, transfer learning, and performance evaluation techniques for image classification tasks.
3. Apply deep feature learning methods, feature descriptors, autoencoders, Siamese networks, and transformer-based approaches for visual feature extraction and representation.
4. Develop and evaluate deep learning models for object detection, image segmentation, and human pose estimation using modern vision architectures and evaluation metrics.

#### UNIT - I

15 Hrs

**Foundations of Deep Learning:** Introduction to Deep Learning and Computer Vision, Artificial Neural Networks and Perceptron, Forward and Backpropagation, Activation Functions: Sigmoid, ReLU and Softmax, Gradient Descent-RMSprop and Adam Optimizer, Bias-Variance Tradeoff, Overfitting and Underfitting

#### UNIT - II

15 Hrs

**Convolutional Neural Networks:** Introduction to CNN, Convolution and Pooling Operations, CNN Architecture and Working Principle, Regularization Techniques: Dropout and Early Stopping, Batch Normalization, CNN Architectures: LeNet, AlexNet and VGGNet, Transfer Learning and Fine-Tuning, Performance Evaluation of CNN Models

#### UNIT - III

15 Hrs

**Deep Feature Learning:** Deep Feature Representation, Feature Descriptors: SIFT, HOG and LBP, Residual Networks (ResNet), Autoencoders and Variational Autoencoders, Siamese Networks and Metric Learning, Basics of Vision Transformers (ViT).



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### UNIT - IV

15 Hrs

**Object Detection and Segmentation:** Fundamentals of Object Detection, Faster R-CNN and YOLO, Semantic Segmentation Basics, Fully Convolutional Networks (FCN), U-Net and Mask R-CNN, Human Pose Estimation, Evaluation Metrics: IoU, Precision, Recall and mAP.

#### TEXT BOOKS

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, *Deep Learning*, 1st Edition, MIT Press, 2016.
2. Richard Szeliski, *Computer Vision: Algorithms and Applications*, 2nd Edition, Springer, 2022.

#### REFERENCE BOOKS

1. Simon J. D. Prince, *Computer Vision: Models, Learning and Inference*, 1st Edition, Cambridge University Press, 2012.
2. Mohamed Elgendy, *Deep Learning for Vision Systems*, 1st Edition, Manning Publications, 2020.
3. François Chollet, *Deep Learning with Python*, 2nd Edition, Manning Publications, 2021.
4. Coursera, *Deep Learning for Computer Vision*, <https://www.coursera.org/learn/convolutional-neural-networks>.
5. NPTEL, *Deep Learning for Computer Vision*, <https://nptel.ac.in/courses/106106224>.
6. Udemy, *Python for Computer Vision with OpenCV and Deep Learning*, <https://www.udemy.com/course/python-for-computer-vision-with-opencv-and-deep-learning>.



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### COURSE CONTENT/SYLLABUS

#### PROFESSIONAL ELECTIVE – SEMESTER VI

| Genome sequencing             |            |                         |                       |      |
|-------------------------------|------------|-------------------------|-----------------------|------|
| Professional Elective         |            |                         | Internal Assessment : | 40   |
| Course Code :                 | UAITL60408 | End Sem. Exam :         |                       | 60   |
| Teaching Hours/Week (L:T:P) : | 3:1:0      | Exam Duration (Hours) : |                       | 2:30 |
| Credits : 4                   |            |                         |                       |      |

#### PREREQUISITES

Basic Biology, Molecular Biology, Probability and Statistics, Programming Fundamentals, Bioinformatics Basics.

#### COURSE OUTCOMES

After completing this Course, the students should be able to:

1. Understand the principles and technologies of genome sequencing.
2. Apply computational methods for genomic data analysis.
3. Analyze sequencing data using bioinformatics tools and algorithms.
4. Evaluate genome assembly and annotation techniques.
5. Design solutions for genomic research and precision medicine applications.

#### UNIT - I

15 Hrs

**Introduction to Genome Sequencing:** Fundamentals of Genomics, DNA Structure and Organization, Genome Sequencing History, Human Genome Project, Biological Databases, Genome Informatics and Applications of Genome Sequencing.

#### UNIT - II

15 Hrs

**Genome Sequencing Technologies:** Sanger Sequencing, Next Generation Sequencing (NGS), Third Generation Sequencing, Illumina and Nanopore Sequencing Platforms, Sequencing Workflows, Sequence Data Formats and Quality Control.

#### UNIT - III

15 Hrs

**Genome Assembly and Annotation:** Sequence Alignment, Genome Assembly Algorithms, Reference-Based and De Novo Assembly, Genome Annotation Techniques, Variant Calling, SNP Analysis, Comparative Genomics.

#### UNIT - IV

15 Hrs

**Bioinformatics and Data Analytics in Genome Sequencing:** Genomic Databases, Machine Learning in Genomics, Transcriptomics and Proteomics, Functional Genomics, Genome Visualization Tools, Cloud Computing and Big Data Analytics in Genomics.

**Applications and Case Studies in Genome Sequencing:** Precision Medicine, Cancer Genomics, Metagenomics, Ethical Issues in Genomics, AI in Genome Analysis.



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### TEXT BOOKS

1. Arthur M. Lesk, Introduction to Genomics, Oxford University Press, 2017.
2. David W. Mount, Bioinformatics: Sequence and Genome Analysis, Cold Spring Harbor Laboratory Press, 2004.
3. Michael S. Waterman, Introduction to Computational Biology: Maps, Sequences and Genomes, CRC Press, 1995.

### REFERENCE BOOKS

1. Dan Gusfield, Algorithms on Strings, Trees and Sequences, Cambridge University Press, 1997.
2. Xinkun Wang, Next Generation Sequencing Data Analysis, CRC Press, 2016.
3. Pevsner Jonathan, Bioinformatics and Functional Genomics, Wiley-Blackwell, 2015.
4. NPTEL Course: Bioinformatics and Computational Biology.
5. Coursera Specialization: Genomic Data Science.



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### COURSE CONTENT/SYLLABUS

#### PROFESSIONAL ELECTIVE - SEMESTER VI

| Security Analytics            |            |                         |      |
|-------------------------------|------------|-------------------------|------|
| Professional Elective         |            | Internal Assessment :   | 40   |
| Course Code :                 | UAITL60409 | End Sem. Exam :         | 60   |
| Teaching Hours/Week (L:T:P) : | 3:1:0      | Exam Duration (Hours) : | 2:30 |
| Credits : 4                   |            |                         |      |

#### PREREQUISITES

Computer Networks, Cyber Security Basics, Database Management Systems, Data Analytics Fundamentals, and Python Programming.

#### COURSE OUTCOMES

After completing this Course, the students should be able to:

1. Understand the concepts and importance of security analytics.
2. Apply data analytics and machine learning techniques for cyber security problems.
3. Analyze security incidents and threat intelligence data.
4. Evaluate cyber threats using security monitoring and analytics tools.
5. Design security analytics solutions for real-world cyber defense applications.

#### UNIT - I

15 Hrs

**Introduction to Security Analytics:** Fundamentals of Cyber Security Analytics, Cyber Threat Landscape, Security Information and Event Management (SIEM), Security Data Collection and Preprocessing, Threat Intelligence, Security Metrics and Visualization.

#### UNIT - II

15 Hrs

**Data Analytics and Machine Learning for Security:** Statistical Analysis for Security, Anomaly Detection, Intrusion Detection Systems, Classification and Clustering Techniques, Machine Learning for Malware Detection, Behavioral Analytics.

#### UNIT - III

15 Hrs

**Advanced Security Analytics:** Network Traffic Analysis, Log Analysis, Cloud Security Analytics, Big Data Analytics for Security, User and Entity Behavior Analytics (UEBA), Incident Response and Threat Hunting.

#### UNIT - IV

15 Hrs

**Applications and Case Studies:** Fraud Detection, Insider Threat Detection, AI in Cyber Security, Security Analytics using Splunk and ELK Stack, Case Studies on Cyber Attacks and Breach Analysis, Mini Project.



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### TEXT BOOKS

1. Mark Ryan Talabis and Robert McPherson, Information Security Analytics, Syngress, 2015.
2. Richard Bejtlich, The Practice of Network Security Monitoring, No Starch Press, 2013.
3. Nina Godbole and Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley, 2011.

### REFERENCE BOOKS

1. Chris Sanders and Jason Smith, Applied Network Security Monitoring, Syngress, 2013.
2. Jay Jacobs and Bob Rudis, Data-Driven Security, Wiley, 2014.
3. William Stallings, Network Security Essentials, Pearson, 2017.
4. NPTEL Course: Cyber Security and Privacy.
5. Coursera Course: Cyber Security Analytics.

|                                                                                                                      |                                                                                                                                                                                                           |                                  |
|----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| <br>CENTRAL UNIVERSITY OF KARNATAKA | <p style="text-align: center;"><b>Central University of<br/>Karnataka</b><br/>(Established by an Act of the Parliament in 2009)</p> <p style="text-align: center;"><b>School of Computer Sciences</b></p> | Dept.: CS                        |
|                                                                                                                      |                                                                                                                                                                                                           | B.Tech CS<br>Course<br>Structure |
|                                                                                                                      |                                                                                                                                                                                                           | 2024-25                          |

## COURSE CONTENT/SYLLABUS

### SEMESTER- VI

| Mini Project                    |            |                       |       |
|---------------------------------|------------|-----------------------|-------|
| Semester:                       | VI         | Internal Assessment   | 20    |
| Course Code:                    | UAIPR60301 | End Sem. Exam         | 30    |
| Teaching Hours/Week<br>(L:T:P): |            | Exam Duration (Hours) | 2 Hrs |
| Credits: 3                      |            |                       |       |

### PREREQUISITE(S)

Prerequisite Course / Knowledge (If any):

Students should have knowledge of programming language and software engineering

### Mini Project

Project work will be carried out either in the department. Each student shall carry out the project work individually/group (Max two members) and May publish the work done in the Conferences or journals. The students are required to submit a soft copy of the project report based on the work done by him/her during the project period. The project topics should be approved from the departmental panel. Students must submit a synopsis separately of more than one topic.

### Synopsis Template

The write up must adhere to the guidelines and should include the following:

- 1 Name / Title of the Project
- 2 Objective and scope of the Project
- 3 Introduction
- 4 Literature Review
- 5 Proposed Methodology
- 6 Experimental Results and Discussion
- 7 Conclusion
- 8 Requirements (Hardware and Software)

**Guidelines for preparing the project Report:**

A4 size page should be used for typing, Left margin: 3.0cm Right margin: 2.0 cm, Top margin: 2.54 cm, Bottom margin: 2.54 cm, All pages as well as should be numbered at the bottom center of the pages. Normal Body Text: Font Size: 12, Times New Roman, Double Spacing, Justified. 6 point above, and below para spacing Paragraph Heading Font Size: 14, Times New Roman, Underlined, Left Aligned. 12 point above & below spacing. Chapter Heading Font Size: 20, Times New Roman, Center Aligned, 30 point above and below spacing. Coding Font size:10, Courier New, Normal

**Submission of Project Report**

Soft copy of the project report shall be submitted through the Moodle LMS course link provided by the internal project guide.



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### COURSE CONTENT/SYLLABUS

#### SEMESTER VII

| Soft Computing                |            |                         |      |  |
|-------------------------------|------------|-------------------------|------|--|
| Semester :                    | VII        | Internal Assessment :   | 25   |  |
| Course Code :                 | UAITC70400 | End Sem. Exam :         | 50   |  |
| Teaching Hours/Week (L:T:P) : | 3:0:2      | Exam Duration (Hours) : | 2:00 |  |
| Credits : 4                   |            |                         |      |  |

#### PREREQUISITES

Basic Programming Skills, Data Structures, Probability and Statistics, and Fundamentals of Artificial Intelligence.

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

1. Explain fuzzy logic concepts and fuzzy set operations used in soft computing systems.
2. Apply fuzzy inference and fuzzy control techniques for intelligent decision-making problems.
3. Analyze optimization problems using genetic algorithms and evolutionary computing techniques.
4. Develop intelligent applications using swarm intelligence and hybrid soft computing approaches.

#### UNIT - I

15 Hrs

##### Fundamentals of Soft Computing and Fuzzy Logic:

Introduction to Soft Computing, Characteristics of Soft Computing, Hard Computing vs. Soft Computing, Crisp Sets and Fuzzy Sets, Membership Functions, Fuzzy Relations and Operations, Fuzzy Rules, Approximate Reasoning, Applications of Fuzzy Logic.

#### UNIT - II

15 Hrs

##### Fuzzy Systems and Genetic Algorithms:

Fuzzification and Defuzzification Methods, Fuzzy Inference Systems, Mamdani and Sugeno Fuzzy Models, Fuzzy Decision Making, Fuzzy Control Systems, Introduction to Genetic Algorithms, Chromosome Representation, Fitness Functions, Selection Methods, Crossover and Mutation Operations, Genetic Algorithm Cycle, Optimization using Genetic Algorithms.

#### UNIT - III

15 Hrs

##### Swarm Intelligence and Soft Computing Applications:

Particle Swarm Optimization (PSO), Ant Colony Optimization (ACO), Swarm Intelligence Concepts, Evolutionary Computing Fundamentals, Hybrid Soft Computing Approaches, Soft Computing for Pattern Recognition, Applications in Robotics, Healthcare, Data Analytics, and Case Studies.



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### List of Experiments Suggested:

1. Implementation of fuzzy set operations.
2. Implementation of membership functions using MATLAB/Python.
3. Conversion of crisp values into fuzzy values (Fuzzification).
4. Defuzzification methods for fuzzy outputs.
5. Design of simple fuzzy rule-based systems.
6. Implementation of Mamdani fuzzy inference model.
7. Solving optimization problems using Genetic Algorithms.
8. Simulation of crossover and mutation operations in Genetic Algorithms.
9. Implementation of Particle Swarm Optimization (PSO) for simple problems.
10. Implementation and comparison of crisp logic and fuzzy logic for temperature control systems.

### TEXT BOOKS

1. Principles of Soft Computing, 2nd Edition, Wiley India Pvt. Ltd., New Delhi, 2011.
2. Neuro-Fuzzy and Soft Computing, 1st Edition, Pearson Education, New Delhi, 2010.

### REFERENCE BOOKS

1. S. N. Sivanandam and S. N. Deepa, Principles of Soft Computing, 2nd Edition, Wiley India Pvt. Ltd., New Delhi, 2011.
2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, 3rd Edition, Wiley India, 2010.
3. NPTEL, Soft Computing, <https://nptel.ac.in/courses/106105173>.
4. Coursera, Introduction to Fuzzy Logic, <https://www.coursera.org/learn/fuzzy-logic>.
5. Coursera, Computational Intelligence, <https://www.coursera.org/learn/computational-intelligence>.
6. Coursera, Neural Networks and Deep Learning, <https://www.coursera.org/learn/neural-networks-deep-learning>.
7. Udemy, Artificial Intelligence and Genetic Algorithms in Python, <https://www.udemy.com/course/genetic-algorithms-in-python>.



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### COURSE CONTENT/SYLLABUS

#### PROFESSIONAL ELECTIVE

| Reinforcement Learning        |            |                         |      |
|-------------------------------|------------|-------------------------|------|
| Professional Elective         |            | Internal Assessment :   | 40   |
| Course Code :                 | UAITL70410 | End Sem. Exam :         | 60   |
| Teaching Hours/Week (L:T:P) : | 3:1:0      | Exam Duration (Hours) : | 2:30 |
| Credits : 4                   |            |                         |      |

#### PREREQUISITES

Programming using Python/C++, Data Structures and Algorithms, Probability and Statistics.

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

1. Explain the fundamentals of reinforcement learning and formulate decision-making problems using Markov Decision Processes.
2. Analyze and implement dynamic programming and model-free reinforcement learning algorithms.
3. Develop value-based, policy-based, and deep reinforcement learning models.
4. Design reinforcement learning solutions for real-world applications using suitable RL frameworks.

#### UNIT - I

15 Hrs

**Foundations of Reinforcement Learning:** Introduction to Reinforcement Learning; Learning Paradigms; Agent-Environment Interaction; Elements of Reinforcement Learning; Rewards, Returns and Episodes; Exploration vs Exploitation; Multi-Armed Bandit Problem;  $\epsilon$ -Greedy and Upper Confidence Bound (UCB) Strategies; Markov Property; Markov Chains; Markov Reward Processes (MRP); Markov Decision Processes (MDP); State-Value and Action-Value Functions; Bellman Expectation and Bellman Optimality Equations.

#### UNIT - II

15 Hrs

**Classical Reinforcement Learning Algorithms:** Dynamic Programming; Policy Evaluation; Policy Improvement; Policy Iteration; Value Iteration; Monte Carlo Prediction and Control; Temporal Difference Learning; TD(0); SARSA; Expected SARSA; Q-Learning; Double Q-Learning; Eligibility Traces; Comparison of Model-Based and Model-Free Learning Algorithms.

#### UNIT - III

15 Hrs

**Function Approximation and Deep Reinforcement Learning:** Function Approximation; Linear Function Approximation; Semi-gradient Methods; Neural Networks for Reinforcement Learning; Deep Q-Network (DQN); Experience Replay; Target Networks; Double DQN; Dueling DQN; Policy Gradient Methods; REINFORCE Algorithm; Actor-Critic Methods; Advantage Actor-Critic (A2C); Proximal Policy Optimization (PPO) – Overview.



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### UNIT - IV

15 Hrs

**Advanced Reinforcement Learning and Applications:** Model-Based Reinforcement Learning; Planning and Learning; Offline Reinforcement Learning; Imitation Learning; Multi-Agent Reinforcement Learning; Meta Reinforcement Learning; Safe Reinforcement Learning; Explainable Reinforcement Learning; Reinforcement Learning Applications in Robotics, Autonomous Systems, Game Playing, Healthcare, Finance, Recommendation Systems, Resource Allocation, and Intelligent Control; Recent Trends and Research Directions.

#### TEXT BOOKS

1. Reinforcement Learning: An Introduction, Richard S. Sutton and Andrew G. Barto, 2nd Edition, MIT Press, 2018.
2. Algorithms for Reinforcement Learning, Morgan & Claypool Publishers, 2010.

#### REFERENCE BOOKS

1. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An Introduction, 2nd Edition, MIT Press, United States, 2018.
2. Csaba Szepesvári, Algorithms for Reinforcement Learning, 1st Edition, Morgan & Claypool Publishers, United States, 2010.
3. Maxim Lapan, Deep Reinforcement Learning Hands-On, 3rd Edition, Packt Publishing, United Kingdom, 2023.
4. Coursera, Reinforcement Learning Specialization (University of Alberta), <https://www.coursera.org/specializations/reinforcement-learning>.
5. NPTEL, Reinforcement Learning, <https://nptel.ac.in/courses>.
6. Udemy, Fundamentals of Reinforcement Learning, <https://www.udemy.com/course/fundamentals-of-reinforcement-learning>.



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### COURSE CONTENT/SYLLABUS

#### PROFESSIONAL ELECTIVE

| Pattern Recognition and Visual Recognition |            |  |                         |      |
|--------------------------------------------|------------|--|-------------------------|------|
| Professional Elective                      |            |  | Internal Assessment :   | 40   |
| Course Code :                              | UAITL70411 |  | End Sem. Exam :         | 60   |
| Teaching Hours/Week (L:T:P) :              | 3:1:0      |  | Exam Duration (Hours) : | 2:30 |
| Credits : 4                                |            |  |                         |      |

#### PREREQUISITES

Machine Learning and Digital image Processing

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

1. Explain the fundamentals of pattern recognition systems, feature extraction and classification techniques.
2. Apply statistical and machine learning approaches for pattern classification and clustering problems.
3. Analyze images using visual recognition techniques such as segmentation, feature analysis and object recognition.
4. Develop visual recognition models using deep learning techniques for real-world applications.

#### UNIT - I

15 Hrs

**Fundamentals of Pattern Recognition:** Introduction to Pattern Recognition and Visual Recognition, Pattern Recognition Systems and Applications, Feature Extraction and Feature Selection, Decision Theory and Bayesian Decision Theory, Statistical Pattern Recognition, Distance Measures and Similarity Metrics, Supervised and Unsupervised Learning Basics

#### UNIT - II

15 Hrs

**Classification and Clustering Techniques:** Linear and Non-linear Classification, Bayesian Classifiers, Fisher Discriminant Analysis, Support Vector Machines, Clustering Techniques and Algorithms, Neural Networks for Pattern Recognition, Hidden Markov Models

#### UNIT - III

15 Hrs

**Fundamentals of Visual Recognition:** Introduction to Computer Vision and Visual Recognition, Image Representation and Image Formation, Image Enhancement and Filtering, Edge Detection and Segmentation, Texture Analysis and Feature-based Recognition, Object Recognition and Scene Analysis, Optical Character Recognition (OCR), Face and Gesture Recognition

#### UNIT - IV

15 Hrs

**Deep Learning for Visual Recognition:** Introduction to Deep Learning for Vision, Convolutional Neural Networks (CNN), Feature Learning using CNN, Object Detection and Image Classification,

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Website: [www.cuk.ac.in](http://www.cuk.ac.in)



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Visual Recognition using Deep Neural Networks, Applications in Biometrics, Medical Imaging and Robotics, Case Studies in Pattern and Visual Recognition

### TEXT BOOKS

1. Richard O. Duda, Peter E. Hart and David G. Stork, *Pattern Classification*, 2nd Edition, Wiley India, 2001.
2. Sergios Theodoridis and Konstantinos Koutroumbas, *Pattern Recognition*, 4th Edition, Academic Press, 2008.

### REFERENCE BOOKS

1. Christopher M. Bishop, *Pattern Recognition and Machine Learning*, 1st Edition, Springer, 2006.
2. Rafael C. Gonzalez and Richard E. Woods, *Digital Image Processing*, 4th Edition, Pearson Education, 2018.
3. Simon J. D. Prince, *Computer Vision: Models, Learning and Inference*, 1st Edition, Cambridge University Press, 2012.
4. NPTEL, *Pattern Recognition and Application*, <https://nptel.ac.in/courses/106108056>.
5. Coursera, *Introduction to Computer Vision and Image Processing*, <https://www.coursera.org/learn/introduction-computer-vision-watson-opencv>.
6. Udemy, *Pattern Recognition and Machine Learning with Python*, <https://www.udemy.com/course/pattern-recognition-and-machine-learning>.



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2024-25

### COURSE CONTENT/SYLLABUS

#### PROFESSIONAL ELECTIVE-SEMESTER VII

| Autonomous Systems          |            |                       |      |
|-----------------------------|------------|-----------------------|------|
| Professional Elective       |            | Internal Assessment : | 40   |
| Course Code :               | UAITL70412 | End Sem. Exam :       | 60   |
| Teaching Hours/Week (L:T:P) | 3:1:0      | Exam Duration (Hours) | 2:30 |
| Credits : 4                 |            |                       |      |

#### PREREQUISITES

Linear Algebra, Probability and Statistics, Python Programming, Artificial Intelligence, Machine Learning, Basics of Robotics and Control Systems.

#### COURSE OUTCOMES

After completing this Course, the students should be able to:

1. Understand the concepts and architecture of autonomous systems.
2. Apply AI, machine learning, and sensor technologies in autonomous systems.
3. Analyze localization, mapping, and navigation techniques.
4. Evaluate decision-making and control strategies in autonomous environments.
5. Design autonomous system solutions for real-world applications.

#### UNIT - I

15 Hrs

**Introduction to Autonomous Systems:** Fundamentals of Autonomous Systems, Types of Autonomous Systems, Sensors and Actuators, Perception Systems, Embedded Systems for Autonomy, Applications of Autonomous Vehicles, Drones and Robots.

#### UNIT - II

15 Hrs

**Localization and Navigation:** Sensor Fusion, GPS and IMU Systems, Kalman Filtering, Localization Techniques, Path Planning Algorithms, Simultaneous Localization and Mapping (SLAM), Obstacle Detection and Avoidance.

#### UNIT - III

15 Hrs

**Artificial Intelligence for Autonomous Systems:** Machine Learning for Autonomous Decision Making, Computer Vision for Autonomous Systems, Object Detection and Tracking, Reinforcement Learning for Navigation, Real-Time Decision Systems.

#### UNIT - III

15 Hrs

**Control and Communication in Autonomous Systems:** Control Strategies, Motion Planning and Trajectory Optimization, Autonomous Vehicle Dynamics, Robot Operating System (ROS), Vehicle-to-Vehicle (V2V) Communication, Ethics, Safety and Security in Autonomous Systems.

**Applications and Case Studies:** Autonomous Cars, Smart Drones, Mobile Robots, Industrial Automation and Smart Manufacturing, Healthcare Robotics, AI-Based Surveillance Systems.



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### TEXT BOOKS

1. Siciliano, B. and Khatib, O., Springer Handbook of Robotics, Springer, 2016.
2. Steven M. LaValle, Planning Algorithms, Cambridge University Press, 2006.
3. Thrun, Burgard and Fox, Probabilistic Robotics, MIT Press, 2005.

### REFERENCE BOOKS

1. Roland Siegwart, Illah Reza Nourbakhsh, and Davide Scaramuzza, Introduction to Autonomous Mobile Robots, MIT Press, 2011.
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press, 2016.
3. Michael A. Hsieh, Autonomous Systems: A Comprehensive Approach, CRC Press, 2022.
4. NPTEL Course: AI for Autonomous Vehicles.
5. Coursera Specialization: Self-Driving Cars.



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### COURSE CONTENT/SYLLABUS

#### PROFESSIONAL ELECTIVE

| Algorithms for DNA Sequencing |            |                         |      |
|-------------------------------|------------|-------------------------|------|
| Professional Elective         |            | Internal Assessment :   | 40   |
| Course Code :                 | UAITL70413 | End Sem. Exam :         | 60   |
| Teaching Hours/Week (L:T:P) : | 3:1:0      | Exam Duration (Hours) : | 2:30 |
| Credits : 4                   |            |                         |      |

#### PREREQUISITES

Data Structures and Algorithms, Probability and Statistics, Programming Fundamentals, Bioinformatics Basics, Molecular Biology.

#### COURSE OUTCOMES

After completing this Course, the students should be able to:

1. Understand computational algorithms used in DNA sequencing and genomics.
2. Apply sequence alignment and genome assembly algorithms.
3. Analyze genomic datasets using bioinformatics tools and computational methods.
4. Evaluate sequencing algorithms and genome analysis techniques.
5. Design computational solutions for DNA sequencing applications.

#### UNIT - I

15 Hrs

**Introduction to DNA Sequencing and Computational Biology:** DNA Structure and Genome Organization, Introduction to Computational Biology, Biological Databases, Genome Sequencing Technologies, Sequence Data Formats, Applications of DNA Sequencing.

#### UNIT - II

15 Hrs

**String Algorithms for DNA Sequencing:** Exact String Matching, Approximate String Matching, Dynamic Programming, Edit Distance, Needleman-Wunsch Algorithm, Smith-Waterman Algorithm, Burrows-Wheeler Transform.

#### UNIT - III

15 Hrs

**Sequence Alignment and Genome Assembly:** Pairwise and Multiple Sequence Alignment, Suffix Trees and Suffix Arrays, De Bruijn Graphs, Reference-Based and De Novo Assembly, Read Mapping Algorithms, Sequence Error Correction.

#### UNIT - IV

15 Hrs

**Algorithms for Genomic Data Analysis:** Variant Calling Algorithms, SNP and Mutation Detection, Comparative Genomics, Phylogenetic Analysis, Machine Learning in Genomics, Big Data Analytics for Sequencing Data.

**Applications and Case Studies:** Personalized Medicine, Cancer Genomics, Metagenomics, Transcriptomics AI Applications in DNA Sequencing, Cloud-Based Genomics Platforms



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### TEXT BOOKS

1. Phillip Compeau and Pavel Pevzner, Bioinformatics Algorithms: An Active Learning Approach, Active Learning Publishers, 2015.
2. Dan Gusfield, Algorithms on Strings, Trees and Sequences, Cambridge University Press, 1997.
3. David W. Mount, Bioinformatics: Sequence and Genome Analysis, Cold Spring Harbor Laboratory Press, 2004.

### REFERENCE BOOKS

1. Michael S. Waterman, Introduction to Computational Biology: Maps, Sequences and Genomes, CRC Press, 1995.
2. Pevsner Jonathan, Bioinformatics and Functional Genomics, Wiley-Blackwell, 2015.
3. Xinkun Wang, Next Generation Sequencing Data Analysis, CRC Press, 2016.
4. NPTEL Course: Bioinformatics Algorithms.
5. Coursera Course: Algorithms for DNA Sequencing.
6. NCBI Genome and Sequence Analysis Resources.



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### COURSE CONTENT/SYLLABUS

#### PROFESSIONAL ELECTIVE - SEMESTER VII

| Privacy and Data Protection   |            |                         |      |
|-------------------------------|------------|-------------------------|------|
| Professional Elective         |            | Internal Assessment :   | 40   |
| Course Code :                 | UAITL70414 | End Sem. Exam :         | 60   |
| Teaching Hours/Week (L:T:P) : | 3:1:0      | Exam Duration (Hours) : | 2:30 |
| Credits : 4                   |            |                         |      |

#### PREREQUISITES

Computer Networks, Database Management Systems, Cyber Security Basics, Fundamentals of Information Technology.

#### COURSE OUTCOMES

After completing this Course, the students should be able to:

1. Understand the concepts of privacy, security, and data protection.
2. Apply data protection techniques and privacy-preserving mechanisms.
3. Analyze legal, ethical, and regulatory frameworks related to data privacy.
4. Evaluate security risks and privacy threats in digital systems.
5. Design privacy-aware and secure systems for real-world applications.

#### UNIT - I

15 Hrs

**Introduction to Privacy and Data Protection:** Concepts of Privacy and Security, Personal Data and Sensitive Data, Privacy Principles, Data Lifecycle, Privacy Threats and Attacks, Data Protection Challenges in Digital Systems.

#### UNIT - II

15 Hrs

**Privacy-Preserving Technologies:** Cryptography Basics, Symmetric and Asymmetric Encryption, Hash Functions and Digital Signatures, Access Control Mechanisms, Authentication and Authorization, Anonymization and Pseudonymization Techniques.

#### UNIT - III

15 Hrs

**Data Protection Regulations and Governance:** GDPR, Indian Digital Personal Data Protection Act (DPDP), Data Protection Policies, Compliance and Governance, Ethical Issues in Data Privacy, Privacy by Design and Security by Design.

#### UNIT - IV

15 Hrs

**Privacy in Emerging Technologies:** Privacy in Cloud Computing, IoT Security and Privacy, Privacy in AI and Machine Learning, Blockchain and Data Protection, Privacy Risks in Social Media and Big Data Analytics.



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### TEXT BOOKS

1. Nina Godbole and Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley, 2011.
2. Paul De Hert and Vagelis Papakonstantinou, Data Protection and Privacy, Intersentia, 2020.
3. William Stallings, Cryptography and Network Security, Pearson, 2017.

### REFERENCE BOOKS

1. Daniel J. Solove, Understanding Privacy, Harvard University Press, 2008.
2. Arshdeep Bahga and Vijay Madisetti, Internet of Things: A Hands-On Approach, Universities Press, 2014.
3. Elisa Bertino and Ravi Sandhu, Database Security and Privacy, IEEE Press.



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### COURSE CONTENT/SYLLABUS

#### OPEN ELECTIVE

| AI for Everyone               |            |                         |      |
|-------------------------------|------------|-------------------------|------|
| Open Elective                 |            | Internal Assessment :   | 25   |
| Course Code :                 | UAICO70402 | End Sem. Exam :         | 25   |
| Teaching Hours/Week (L:T:P) : | 2:0:2      | Exam Duration (Hours) : | 1:30 |
| Credits : 3                   |            |                         |      |

#### PREREQUISITES

Basic computer knowledge, logical reasoning, and interest in Artificial Intelligence applications.

#### COURSE OUTCOMES

After completing this Course, the students should be able to:

1. Understand the basic concepts and terminology of Artificial Intelligence.
2. Identify real-world applications of AI across different domains.
3. Analyze the impact of AI on society, business, and employment.
4. Evaluate ethical, legal, and social challenges in AI systems.
5. Apply AI concepts to simple real-world problem-solving scenarios.

#### UNIT - I

15 Hrs

#### Foundations of Artificial Intelligence and Core Technologies:

Introduction to Artificial Intelligence, History and Evolution of AI, Types of AI, AI vs Machine Learning vs Deep Learning, Applications of AI in Daily Life, Healthcare, Education, Agriculture, and Smart Cities, Basics of Machine Learning, Supervised and Unsupervised Learning, Neural Networks and Deep Learning, Natural Language Processing, Computer Vision, Recommendation Systems, Introduction to Generative AI and Chatbots.

#### UNIT - II

15 Hrs

#### AI Applications, Ethics, and Society:

AI Project Lifecycle, Data Collection and Preprocessing, AI Tools and Platforms, AI in Business and Industry, Smart Assistants and Autonomous Systems, AI for Decision Making, Ethical AI, Bias and Fairness, Privacy and Security Issues, Responsible AI, AI Governance and Regulations, Impact of AI on Employment and Society, Risks and Challenges of AI, Real-World Case Studies.



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### List of Experiments Suggested:

1. Introduction to AI tools such as ChatGPT and Google Gemini.
2. Simple machine learning model implementation using Python.
3. Image classification using pre-trained AI models.
4. Text generation and chatbot development basics.
5. Sentiment analysis using NLP tools.
6. Recommendation system demonstration.
7. AI ethics and bias analysis activity.
8. Case study analysis of self-driving systems.
9. AI application development using no-code AI platforms.
10. Mini Project on AI-based real-world applications.

### TEXT BOOKS

1. Andrew Ng, AI for Everyone, DeepLearning.AI Course Material, 2019.
2. Melanie Mitchell, Artificial Intelligence: A Guide for Thinking Humans, Farrar, Straus and Giroux, 2019.
3. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson, 2021.

### REFERENCE BOOKS

1. Kai-Fu Lee, AI Superpowers, Houghton Mifflin Harcourt, 2018.
2. Tom Taulli, Artificial Intelligence Basics: A Non-Technical Introduction, Apress, 2019.
3. Bernard Marr, Artificial Intelligence in Practice, Wiley, 2019.
4. NPTEL Course: Introduction to Artificial Intelligence by IIT Kharagpur.
5. Coursera Course: AI for Everyone by Andrew Ng.
6. Research papers and reports on AI Ethics and Responsible AI.



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### COURSE CONTENT/SYLLABUS

#### OPEN ELECTIVE

| Robotics                    |            |                       |  |      |
|-----------------------------|------------|-----------------------|--|------|
| Open Elective               |            | Internal Assessment : |  | 25   |
| Course Code :               | UAICO70403 | End Sem. Exam :       |  | 25   |
| Teaching Hours/Week (L:T:P) | 2:0:2      | Exam Duration (Hours) |  | 1:30 |
| Credits : 3                 |            |                       |  |      |

#### PREREQUISITES

Basic Programming Skills, Fundamental Mathematics, Logical Reasoning, and Interest in Robotics and Intelligent Systems.

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

1. Explain robot configurations, kinematics, sensors and control mechanisms used in robotics systems.
2. Apply motion planning, localization and machine vision techniques in robotic systems.
3. Analyze autonomous robotic applications using AI and robot programming concepts.

#### UNIT - I

15 Hrs

##### Fundamentals of Robotics and Robot Motion:

Introduction to Robotics, Robot Anatomy and Configurations, Coordinate Systems and Transformations, Forward and Inverse Kinematics, Sensors and Actuators, Robot Control Basics, Robot Dynamics Fundamentals, Trajectory Planning, Motion Planning, Mobile Robotics, Industrial Applications of Robots.

#### UNIT - II

15 Hrs

##### Intelligent Robotics and Applications:

Localization and Mapping Basics, Machine Vision for Robotics, Object Detection and Recognition, Autonomous Navigation, Path Planning Techniques, AI in Robotics, Human-Robot Interaction, Robot Programming Basics, Applications of Robotics in Healthcare, Industry, and Smart Systems, Case Studies of Autonomous Robots.



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### List of Experiments Suggested:

1. Interfacing LED and buzzer with Arduino for robotic indication systems.
2. Controlling DC motor movement using Arduino.
3. Servo motor control for robotic arm movement.
4. Interfacing ultrasonic sensor for obstacle detection.
5. Line follower robot using IR sensors.
6. Bluetooth controlled robot using mobile application.
7. Robot movement control using Wi-Fi module.
8. Simple pick-and-place robotic arm simulation.
9. Object detection using webcam and OpenCV basics.
10. Obstacle avoidance robot using sensors and Arduino.

### TEXT BOOKS

1. Saeed B. Niku, *Introduction to Robotics: Analysis, Control and Applications*, 2nd Edition, Wiley India, 2010.
2. John J. Craig, *Introduction to Robotics: Mechanics and Control*, 3rd Edition, Pearson Education, 2004.

### REFERENCE BOOKS

1. M. P. Groover, *Industrial Robotics: Technology, Programming and Applications*, 1st Edition, McGraw-Hill Education, 2010.
2. Robin R. Murphy, *Introduction to AI Robotics*, 2nd Edition, MIT Press, 2019.
3. Richard D. Klafter, Thomas A. Chmielewski and Michael Negin, *Robotic Engineering: An Integrated Approach*, 1st Edition, PHI Learning, 1989.
4. NPTEL, *Introduction to Robotics*, <https://nptel.ac.in/courses/112101099>.
5. Coursera, *Modern Robotics: Mechanics, Planning, and Control*, <https://www.coursera.org/specializations/modernrobotics>.
6. Udemy, *Robotics and ROS – Learn by Doing*, <https://www.udemy.com/course/robotics-and-ros-learn-by-doing>



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### SEMESTER VIII

| Technical Seminar           |   |            |                       |   |                                |
|-----------------------------|---|------------|-----------------------|---|--------------------------------|
| Course Code                 | : | UAIPR70400 | End Sem. Presentation | : | 100                            |
| Teaching Hours/Week (L:T:P) | : | 0:0:2      | Evaluation            | : | Continuous Internal Evaluation |
| Credits : 2                 |   |            |                       |   |                                |

### PREREQUISITES

- Basic understanding of the core subjects related to the chosen seminar topic.
- Ability to search, read, and understand technical papers, journals, and conference articles.
- Fundamental communication and presentation skills.
- Basic knowledge of report writing and documentation.
- Awareness of recent technologies and emerging trends in Computer Science and Engineering.
- Ability to use presentation tools such as PowerPoint, LaTeX, or equivalent software.

### COURSE OUTCOMES

After completing this Course, the students should be able to:

1. Identify and study recent trends, technologies, and research developments in the chosen domain.
2. Analyze and summarize technical literature, journals, and research papers.
3. Prepare technical reports and professional seminar presentations.
4. Deliver effective oral presentations with clarity, confidence, and technical accuracy.
5. Respond to questions and participate in technical discussions with analytical.

### Guidelines for Conduct of Technical Seminar

1. Each student shall select a seminar topic related to emerging technologies, research trends, or industrial applications.
2. The topic should preferably be selected from reputed journals, conferences, patents, or industrial case studies.
3. Students must consult a faculty mentor for approval of the seminar topic.
4. A seminar report shall be prepared in standard technical report format.
5. The seminar presentation duration should be 20–25 minutes followed by 5–10 minutes of discussion and questions.
6. Students should use audio-visual aids and demonstrate professional presentation practices.
7. Plagiarism must be avoided and proper citations/references should be included.
8. Students are encouraged to use IEEE/APA formatting standards for references.
9. Attendance and active participation in peer seminars are mandatory.
10. Evaluation shall be carried out continuously by the faculty panel based on the approved rubric.



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### Suggested Marks Distribution

| Component                             | Marks |
|---------------------------------------|-------|
| Topic Selection and Literature Survey | 5     |
| Technical Content and Understanding   | 10    |
| Presentation Skills                   | 10    |
| Seminar Report                        | 10    |
| Question & Answer Session             | 10    |
| Participation and Attendance          | 5     |
| Total                                 | 50    |

|                                                                                                                      |                                                                                                                                                                                                           |                  |
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|                                                                                                                      |                                                                                                                                                                                                           | B.Tech CS Course |
|                                                                                                                      |                                                                                                                                                                                                           | 2024-25          |

## COURSE CONTENT/SYLLABUS

### SEMESTER- VII

| Industrial/ Research Internship         |                   |                              |  |
|-----------------------------------------|-------------------|------------------------------|--|
| <b>Semester:</b>                        | <b>VII</b>        | <b>Internal Assessment</b>   |  |
| <b>Course Code:</b>                     | <b>UAIP170400</b> | <b>End Sem. Exam</b>         |  |
| <b>Teaching Hours/Week<br/>(L:T:P):</b> |                   | <b>Exam Duration (Hours)</b> |  |
| <b>Credits: 4</b>                       |                   |                              |  |

### PREREQUISITE(S)

Prerequisite Course / Knowledge (If any):

- Students should have knowledge of programming language and software engineering.

### COURSE OUTCOMES

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

- Create websites for Academics, PSU, Industries etc. (Level 6 Create)
- Generate the documentation of project work. (Level 6 Create)
- Develop a model that solves real time social issues. (Level 6 Create)
- Develop the module and implement the concepts of computers. (Level 6 Create)
- Sketch the data flow of project (Level 3 Apply)

### DETAILED SYLLABUS

#### Project Work

Project work will be carried out either in the department or in any Institution / Industry under the supervision of guide (s) approved by the Department of Computer Science.

- 1 Each student shall carry out the project work individually and publish the work done in the Conferences or Scopus/SCI Journals.
- 2 The students are required to submit three copies of the project report (dissertation) based on the work done by him/her during the project period. The project topics should be based on the syllabus or beyond.

## PROJECT DISSERTATION FORMAT

### SUMMARY/ ABSTRACT:

All students must submit a summary/abstract separately with the project report. Summary, preferably, should be of about 3, 4 pages. The content should be as brief as is sufficient enough to explain the objective and implementation of the project that the candidate is going to take up. The write up must adhere to the guidelines and should include the following:

- 1 Name / Title of the Project
- 2 Statement about the Problem
- 3 Why is the particular topic chosen?
- 4 Objective and scope of the Project
- 5 Methodology (including a summary of the project)
- 6 Hardware & Software to be used
- 7 Testing Technologies used
- 8 What contribution would the project make?

### TOPIC OF THE PROJECT:

This should be explicitly mentioned at the beginning of the Synopsis. Since the topic itself gives a peep into the project to be taken up, candidates are advised to be prudent on naming the project. This being the overall impression on the future work, the topic should corroborate the work.

### OBJECTIVE AND SCOPE:

This should give a clear picture of the project. Objective should be Clearly specified. What the project ends up to and in what way this is going to help the end user has to be mentioned.

### PROCESS DESCRIPTION:

The process of the whole software system proposed, to be developed, should be mentioned in brief. This may be supported by DFD / Flowcharts to explain the flow of the information.

### RESOURCES AND LIMITATIONS:

The requirement of the resources for designing and developing the proposed system must be given. The resources might be in form of the hardware/software or the data from the industry. The limitation of the proposed system in respect of a larger and comprehensive system must be given.

### CONCLUSION:

The write-up must end with the concluding remarks briefly describing innovation in the approach for implementing the Project, main achievements and also any other important feature that makes the system stand out from the rest.

**The following suggested guidelines must be followed in preparing the Final project Report:**

Good quality white executive bond paper A4 size should be used for typing and duplication. Care should be taken to avoid smudging while duplicating the copies.

Page Specification: (Written paper and source code)

Left margin: 3.0cms

Right margin: 2.0cms

Top margin: 2.54cms

Bottom margin: 2.54cms

Page numbers, All text pages as well as Program source code listing should be numbered at the bottom center of the pages. Normal Body Text: Font Size: 12, Times New Roman, Double Spacing, Justified. 6 point above and below para spacing Paragraph Heading Font Size: 14, Times New Roman, Underlined, Left Aligned. 12 point above & below spacing. Chapter Heading Font Size: 20, Times New Roman, Center Aligned, 30 point above and below spacing. Coding Font size: 10, Courier New, Normal.

**Submission of Project Report to University:** The student will submit his/her project report in the prescribed format. The Project Report should include:

- 1 One copy of the summary/abstract.
- 2 Soft copy of the project report shall be submitted through the Moodle LMS course link provided by the internal project guide.
- 3 The Project Report may be about 75 pages (excluding coding)

|                                                                                                                      |                                                                                                                                                                                                           |                                  |
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|                                                                                                                      |                                                                                                                                                                                                           | B.Tech CS<br>Course<br>Structure |
|                                                                                                                      |                                                                                                                                                                                                           | 2024-25                          |

## COURSE CONTENT/SYLLABUS

### SEMESTER- VII

| Capstone Project Phase I                |                   |                              |            |
|-----------------------------------------|-------------------|------------------------------|------------|
| <b>Semester:</b>                        | <b>VII</b>        | <b>Internal Assessment</b>   | <b>50</b>  |
| <b>Course Code:</b>                     | <b>UAIPR70401</b> | <b>End Sem. Exam</b>         | <b>100</b> |
| <b>Teaching Hours/Week<br/>(L:T:P):</b> |                   | <b>Exam Duration (Hours)</b> |            |
| <b>Credits: 6</b>                       |                   |                              |            |

### PREREQUISITE(S)

Prerequisite Course / Knowledge (If any):

- Students should have knowledge of programming language and software engineering

### CAPSTONE PROJECT PHASE I

### RATIONALE

Capstone Project Phase I enables students to identify real-world problems, conduct detailed literature review, perform feasibility analysis, and design innovative solutions. The course focuses on project planning, requirement analysis, methodology selection, and system design before implementation.

Students are encouraged to work on interdisciplinary, socially relevant, and industry-oriented problems.

### INDUSTRY / EMPLOYER EXPECTED OUTCOME

Analyze and design innovative solutions for real-world engineering and research problems.

### COURSE OUTCOMES (COs)

After completion of this course, students can able to:

- Identify and formulate a research/problem statement based on societal, industrial, or interdisciplinary needs.
- Conduct extensive literature survey, data collection, and feasibility analysis using appropriate tools and methodologies.
- Design the proposed system architecture, methodology, workflow, and implementation plan for the selected project.
- Prepare and present a detailed project synopsis, review report, and design documentation following standard research practices.

### SCOPE OF PHASE I

- Problem Identification and Need Analysis
- Literature Survey and Gap Identification
- Requirement Analysis
- Feasibility Study (Technical, Financial, Operational)
- Dataset / Resource Identification
- Methodology and System Design
- Project Planning
- Prototype Design / Architecture Diagram
- Synopsis and Review Presentation

### ASSESSMENT GUIDELINES

| Criteria                           | Marks |
|------------------------------------|-------|
| Problem Definition and Innovation  | 10    |
| Literature Survey and Research Gap | 10    |
| Feasibility Analysis and Planning  | 10    |
| System Design / Methodology        | 10    |
| Synopsis Report and Presentation   | 10    |

### GUIDELINES FOR STUDENTS

- Projects should preferably address real-world or industry problems.
- Students shall work in teams of 2–4 members.
- A detailed literature survey from IEEE, Springer, Elsevier, Scopus, or SCI-indexed journals must be carried out.
- Plagiarism in synopsis or literature review should be avoided.
- Students must prepare weekly progress reports and maintain project diaries.
- The final Phase I review must include methodology, architecture, expected outcomes, and implementation plan.
- Students are encouraged to identify patentable ideas at the design stage.

### GUIDELINES FOR FACULTY MEMBERS

- Faculty mentors shall guide students in selecting innovative and feasible project topics.
- Mentors should ensure that the literature survey is authentic and technically relevant.
- Faculty members shall monitor weekly progress and conduct regular reviews.
- Mentors should encourage interdisciplinary and industry-sponsored projects.
- Faculty shall guide students toward publication-quality research and patent-oriented work.
- Faculty should ensure ethical practices, originality, and proper documentation.

### EXPECTED DELIVERABLES

#### Project Synopsis

- Introduction
- Literature Survey Report
- Problem Statement and Objectives
- Literature Review
- System Design / Architecture
- Requirement and Feasibility Analysis
- Review Presentation



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# Central University of Karnataka

(Established by an Act of the Parliament in 2009)

## School of Computer Science

Dept.: Computer Science

B. Tech. in Computer Science

Syllabus

2024-25

### COURSE CONTENT/SYLLABUS

#### PROFESSIONAL ELECTIVE-SEMESTER VIII

| Solve Business Problems With AI |            |                       |      |
|---------------------------------|------------|-----------------------|------|
| Professional Elective           |            | Internal Assessment : | 40   |
| Course Code :                   | UAITL80415 | End Sem. Exam :       | 60   |
| Teaching Hours/Week (L:T:P)     | 3:1:0      | Exam Duration (Hours) | 2:30 |
| Credits : 4                     |            |                       |      |

#### PREREQUISITES

Basics of Programming, Fundamentals of Data Science, Statistics, Introduction to Artificial Intelligence and Machine Learning.

#### COURSE OUTCOMES

After completing this Course, the students should be able to:

1. Understand the role of Artificial Intelligence in solving business problems.
2. Apply AI and machine learning techniques for business analytics and decision making.
3. Analyze business datasets using predictive and prescriptive analytics.
4. Evaluate AI-driven solutions for real-world business applications.
5. Design AI-based systems to improve business processes and customer experience.

#### UNIT - I

15 Hrs

**Introduction to AI in Business:** Fundamentals of Artificial Intelligence, AI Applications in Business, Business Intelligence and Analytics, Data-Driven Decision Making, Data Collection and Preprocessing, Ethical Issues in AI for Business.

#### UNIT - II

15 Hrs

**Machine Learning for Business Analytics:** Supervised and Unsupervised Learning, Regression and Classification Techniques, Clustering for Customer Segmentation, Recommendation Systems, Predictive Analytics, Performance Evaluation Metrics.

#### UNIT - III

15 Hrs

**AI for Business Process Automation:** Intelligent Automation, Chatbots and Virtual Assistants, Natural Language Processing for Business, Robotic Process Automation (RPA), AI in Supply Chain and Inventory Management, Fraud Detection.

#### UNIT - IV

15 Hrs

**Advanced AI Applications in Business:** Deep Learning Basics, AI for Marketing Analytics, Financial Forecasting using AI, AI in Healthcare and E-Commerce, AI Strategy and Business Transformation.

**Case Studies and Real-World Applications:** AI for Customer Relationship Management, Social Media Analytics, Business Forecasting, AI-Based Decision Support Systems, Cloud AI Services, Generative AI for Business Applications.



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### TEXT BOOKS

1. Tom Taulli, Artificial Intelligence Basics: A Non-Technical Introduction, Apress, 2019.
2. Foster Provost and Tom Fawcett, Data Science for Business, O'Reilly Media, 2013.
3. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition, O'Reilly, 2022.

### REFERENCE BOOKS

1. Andreas C. Müller & Sarah Guido, Introduction to Machine Learning with Python, O'Reilly, 2016.
2. Bernard Marr, Artificial Intelligence in Practice, Wiley, 2019.
3. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press, 2016.
4. NPTEL Course: AI for Business Applications.
5. Coursera Specialization: AI for Everyone by Andrew Ng.
6. Harvard Business Review Articles on AI and Business Analytics.



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### COURSE CONTENT/SYLLABUS

#### PROFESSIONAL ELECTIVE – SEMESTER VIII

| AI in Gaming                |            |                       |      |
|-----------------------------|------------|-----------------------|------|
| Professional Elective       |            | Internal Assessment : | 40   |
| Course Code :               | UAITL80416 | End Sem. Exam :       | 60   |
| Teaching Hours/Week (L:T:P) | 3:1:0      | Exam Duration (Hours) | 2:30 |
| Credits : 4                 |            |                       |      |

#### PREREQUISITES

Programming Fundamentals, Data Structures and Algorithms, Artificial Intelligence Basics, Probability and Linear Algebra.

#### COURSE OUTCOMES

After completing this Course, the students should be able to:

1. Understand the role of Artificial Intelligence in game development.
2. Apply AI techniques for game agents, navigation, and decision-making.
3. Analyze game-playing algorithms and intelligent behaviors.
4. Evaluate machine learning and reinforcement learning methods in games.
5. Design intelligent and adaptive gaming systems.

#### UNIT - I

15 Hrs

**Introduction to AI in Gaming:** Fundamentals of Game AI, History and Evolution of AI in Games, Game Architectures, Intelligent Agents, Finite State Machines, Rule-Based Systems, AI in Modern Game Engines.

#### UNIT - II

15 Hrs

**Movement and Navigation in Games:** Pathfinding Algorithms, A\* Algorithm, Navigation Meshes, Steering Behaviors, Collision Detection and Avoidance, Motion Planning, Behavior Trees for Game AI.

#### UNIT - III

15 Hrs

**Game Playing and Decision Making:** Minimax Algorithm, Alpha-Beta Pruning, Monte Carlo Tree Search, Game Theory Basics, Strategy Planning, Opponent Modeling, Multi-Agent Systems in Games.

#### UNIT - IV

15 Hrs

**Machine Learning and Reinforcement Learning in Games:** Supervised Learning for Games, Reinforcement Learning, Deep Reinforcement Learning, Procedural Content Generation, Adaptive Difficulty Systems, Player Modeling and Analytics.

**Advanced Topics and Applications:** AI in Virtual Reality and Augmented Reality Games, Generative AI in Game Design, Ethics in AI Gaming, Case Studies using Unity and Unreal Engine.



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### TEXT BOOKS

1. Ian Millington and John Funge, Artificial Intelligence for Games, CRC Press, 2019.
2. Georgios N. Yannakakis and Julian Togelius, Artificial Intelligence and Games, Springer, 2018.
3. Steve Rabin, Introduction to Game Development, Charles River Media, 2010.

### REFERENCE BOOKS

1. Mat Buckland, Programming Game AI by Example, Jones & Bartlett Learning, 2004.
2. David M. Bourg and Glenn Seemann, AI for Game Developers, O'Reilly Media, 2004.
3. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An Introduction, MIT Press, 2018.
4. NPTEL Course: Artificial Intelligence by IIT Kharagpur.
5. Unreal Engine AI and Gameplay Documentation.



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### COURSE CONTENT/SYLLABUS

#### PROFESSIONAL ELECTIVE

| AI in Healthcare              |            |                         |      |
|-------------------------------|------------|-------------------------|------|
| Professional Elective         |            | Internal Assessment :   | 40   |
| Course Code :                 | UAITL80417 | End Sem. Exam :         | 60   |
| Teaching Hours/Week (L:T:P) : | 3:1:0      | Exam Duration (Hours) : | 2:30 |
| Credits : 4                   |            |                         |      |

#### PREREQUISITES

Machine Learning Basics and Data Analytics

#### COURSE OUTCOMES

After completion of this course successfully, the students will be able to

1. Explain the fundamentals, challenges and applications of AI in healthcare systems.
2. Apply machine learning and data analytics techniques for healthcare data analysis and clinical decision support.
3. Analyze medical images using deep learning techniques for disease diagnosis and prediction.
4. Evaluate advanced healthcare AI applications.

#### UNIT - I

15 Hrs

**Fundamentals of AI in Healthcare:** Introduction to Artificial Intelligence in Healthcare, Healthcare Data and Medical Informatics, Electronic Health Records (EHR), AI and Machine Learning Basics for Healthcare, Clinical Data Analytics, Applications of AI in Healthcare, Challenges in Healthcare AI Systems.

#### UNIT - II

15 Hrs

**Machine Learning and Medical Data Analysis:** Supervised and Unsupervised Learning in Healthcare, Predictive Analytics for Clinical Decision Support, Time-series Analysis of Healthcare Data, Natural Language Processing for Clinical Text, Healthcare Recommendation Systems, Explainable AI in Healthcare, Evaluation Metrics for Healthcare AI Models

#### UNIT - III

15 Hrs

**Deep Learning for Medical Imaging:** Introduction to Medical Image Analysis, Deep Learning for Medical Imaging, Convolutional Neural Networks for Diagnosis, Image Segmentation and Object Detection, Disease Prediction using Medical Images, AI Applications in Radiology and Pathology, Multimodal Healthcare Data Analysis.

#### UNIT - IV

15 Hrs

**AI Healthcare Applications:** Personalized Medicine and Genomic Analysis, AI in Drug Discovery and Development, AI-assisted Diagnostics and Robotic Surgery, Wearable Devices and Remote Patient Monitoring, Case Studies in Real-world Healthcare Applications.



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### TEXT BOOKS

1. Arjun Panesar, *Machine Learning and AI for Healthcare: Big Data for Improved Health Outcomes*, 1st Edition, Apress, 2019.
2. Adam Bohr and Kaveh Memarzadeh, *Artificial Intelligence in Healthcare*, 1st Edition, Academic Press, 2020.

### REFERENCE BOOKS

1. Sergio Consoli, Diego Reforgiato Recupero and Milan Petkovic, *Data Science for Healthcare: Methodologies and Applications*, 1st Edition, Springer, 2019.
2. Andreas Holzinger, *Artificial Intelligence in Health: Applications, Ethics and Practical Considerations*, 1st Edition, Springer, 2016.
3. Deepak Gupta, Ashish Khanna and Siddhartha Bhattacharyya, *Artificial Intelligence for Healthcare Applications and Management*, 1st Edition, Academic Press, 2021.
4. Coursera, *AI for Medicine Specialization*, <https://www.coursera.org/specializations/ai-for-medicine>.
5. NPTEL, *AI in Healthcare*, <https://nptel.ac.in/courses/106106214>.
6. Udemy, *Artificial Intelligence in Healthcare*, <https://www.udemy.com/course/artificial-intelligence-in-healthcare>.



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### COURSE CONTENT/SYLLABUS

#### PROFESSIONAL ELECTIVE

| AI in Finance                 |            |                         |      |
|-------------------------------|------------|-------------------------|------|
| Professional Elective         |            | Internal Assessment :   | 40   |
| Course Code :                 | UAITL80418 | End Sem. Exam :         | 60   |
| Teaching Hours/Week (L:T:P) : | 3:1:0      | Exam Duration (Hours) : | 2:30 |
| Credits : 4                   |            |                         |      |

#### PREREQUISITES

Probability and Statistics, Python Programming, Machine Learning Basics, Data Structures, Fundamentals of Finance.

#### COURSE OUTCOMES

After completing this Course, the students should be able to:

1. Understand the applications of Artificial Intelligence in finance.
2. Apply machine learning and data analytics techniques to financial problems.
3. Analyze financial datasets for prediction and decision-making.
4. Evaluate AI-driven financial models and risk analysis techniques.
5. Design intelligent financial systems using AI technologies.

#### UNIT - I

15 Hrs

**Introduction to AI in Finance:** Fundamentals of Financial Systems, Introduction to Artificial Intelligence and FinTech, Financial Data Sources, Data Preprocessing and Visualization, AI Applications in Banking and Financial Services.

#### UNIT - II

15 Hrs

**Machine Learning for Financial Analytics:** Supervised and Unsupervised Learning, Regression and Classification for Finance, Clustering and Customer Segmentation, Time Series Forecasting, Stock Market Prediction, Financial Performance Metrics.

#### UNIT - III

15 Hrs

**AI Techniques in Financial Decision Making:** Credit Scoring, Fraud Detection, Algorithmic Trading, Portfolio Optimization, Risk Management, Recommendation Systems in Finance.

#### UNIT - IV

15 Hrs

**Advanced AI in Finance:** Deep Learning for Financial Analytics, Natural Language Processing for Financial Text Analysis, Reinforcement Learning in Trading Systems, Explainable AI in Finance, Blockchain and AI Integration, Ethical AI in Finance.

**Applications and Case Studies:** AI in Banking, Insurance and Investment Analytics, Robo-Advisors, Financial Chatbots, Fraud Analytics, AI for Cryptocurrency and Digital Payments.



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### TEXT BOOKS

1. Yves Hilpisch, Artificial Intelligence in Finance, O'Reilly Media, 2020.
2. Foster Provost and Tom Fawcett, Data Science for Business, O'Reilly Media, 2013.
3. Paul Wilmott, Machine Learning: An Applied Mathematics Introduction, Wiley, 2019.

### REFERENCE BOOKS

1. Longbing Cao, AI in Finance: Challenges, Techniques and Opportunities, Springer, 2021.
2. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An Introduction, MIT Press, 2018.
3. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly, 2022.
4. NPTEL Course: AI for Finance.
5. Coursera Specialization: Machine Learning for Trading.
6. Research Articles from IEEE and ACM on AI in Finance.

|                                                                                                                      |                                                                                                                                                                                                                                          |                                  |
|----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| <br>CENTRAL UNIVERSITY OF KARNATAKA | <p style="text-align: center;"><b>Central University of<br/>Karnataka</b></p> <p style="text-align: center;">(Established by an Act of the Parliament in 2009)</p> <p style="text-align: center;"><b>School of Computer Sciences</b></p> | Dept.: CS                        |
|                                                                                                                      |                                                                                                                                                                                                                                          | B.Tech CS<br>Course<br>Structure |
|                                                                                                                      |                                                                                                                                                                                                                                          | 2024-25                          |

## COURSE CONTENT/SYLLABUS

### SEMESTER- VIII

| <b>Capstone Project Phase II</b>        |                   |                              |            |
|-----------------------------------------|-------------------|------------------------------|------------|
| <b>Semester:</b>                        | <b>VIII</b>       | <b>Internal Assessment</b>   | <b>50</b>  |
| <b>Course Code:</b>                     | <b>UAIPR80402</b> | <b>End Sem. Exam</b>         | <b>100</b> |
| <b>Teaching Hours/Week<br/>(L:T:P):</b> |                   | <b>Exam Duration (Hours)</b> |            |
| <b>Credits: 12</b>                      |                   |                              |            |

### PREREQUISITE(S)

Prerequisite Course / Knowledge (If any):

Students should have knowledge of programming language and software engineering

### CAPSTONE PROJECT PHASE II

### RATIONALE

Capstone Project Phase II focuses on implementation, experimentation, testing, validation, deployment, and dissemination of the proposed solution designed in Phase I. Students are expected to develop complete working systems, perform analysis, validate results, and present publishable or patentable outcomes.

### INDUSTRY / EMPLOYER EXPECTED OUTCOME

Develop, implement, validate, and present innovative engineering solutions with research and publication outcomes.

### COURSE OUTCOMES (COs)

1. Implement the proposed solution using suitable tools, technologies, platforms, and methodologies.
2. Perform testing, experimentation, performance evaluation, and result validation of the developed system.
3. Prepare research manuscripts/patents, technical reports, and demonstrations based on project outcomes.
4. Present the completed project through viva voce, publications, prototype demonstrations, and final dissertation.

### SCOPE OF PHASE II

- System Implementation and Development
- Experimental Setup and Testing
- Performance Analysis and Validation

- Optimization and Fine-Tuning
- Prototype Demonstration
- Research Paper Writing/ Patent Drafting and Filing
- Final Thesis Preparation
- Project Presentation and Viva Voce

## **PUBLICATION / PATENT REQUIREMENTS**

- Every student group shall submit at least one manuscript to a Scopus-indexed or SCI-indexed journal/conference.
- Students should attempt patent drafting and filing for novel and innovative outcomes.
- Publication details and patent status shall be included in the final project report.
- The faculty mentor shall verify the originality and publication quality of the work.

## **ASSESSMENT GUIDELINES**

| <b>Criteria</b>                   | <b>Marks</b> |
|-----------------------------------|--------------|
| Implementation and Functionality  | 20           |
| Testing and Result Validation     | 15           |
| Innovation / Optimization         | 10           |
| Publication / Patent Contribution | 15           |
| Final Report and Dissertation     | 20           |
| Project Presentation and Viva     | 20           |

## **GUIDELINES FOR STUDENTS**

- Students shall complete implementation according to the approved design from Phase I.
- All experimental results and observations must be documented systematically.
- Students must maintain source code, datasets, hardware details, and experimental logs.
- The final report shall follow standard dissertation/report writing formats.
- Students are strongly encouraged to publish in SCI/Scopus-indexed journals or conferences.
- Innovative projects should be converted into patent applications wherever applicable.
- Proper citation, referencing, and plagiarism-free documentation are mandatory.

## **GUIDELINES FOR FACULTY MEMBERS**

- Faculty mentors shall continuously monitor implementation progress and technical quality.
- Mentors should encourage publication-oriented and patent-oriented outcomes.
- Faculty members shall conduct regular reviews and validate experimental results.
- Mentors shall ensure ethical research practices and originality in publications.
- Faculty should facilitate industry interaction, deployment opportunities, and technology transfer.
- Faculty shall verify final dissertation quality and project completion.

## **EXPECTED DELIVERABLES**

Working Prototype / Software / Hardware

- Experimental Results and Validation Reports
- Research Paper Submission Proof
- Patent Draft / Filing Documents (if applicable)
- Final Dissertation
- Source Code / Design Files
- Project Demonstration and Viva Presentation