# SDM College of Engineering and Technology, Dharwad – 580002

## Department of Computer Science and Engineering

## 2018 Scheme

### I/II semester B. E. (Common to all Branches)

### Physics cycle

| Course Code | Course Category | Course Title | Teaching | | Examination | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L-T-P (Hrs/Week) | Credits | CIE | Theory (SEE) | | Practical (SEE) | |
| | | | | | Max. Marks | *Max. Marks | Duration in Hrs. | Max. Marks | Duration In Hrs. |
| 18UMAC100 | BS | Engineering Mathematics-I | 3 - 2 - 0 | 4 | 50 | 100 | 3 | - | - |
| 18UPHC100 | BS | Engineering Physics | 3 - 2 - 0 | 4 | 50 | 100 | 3 | - | - |
| 18UEEC100 | ES | Basic Electrical Engineering | 3 - 0 - 0 | 3 | 50 | 100 | 3 | - | - |
| 18UCVC100 | ES | Engineering Mechanics | 3 - 0 - 0 | 3 | 50 | 100 | 3 | - | - |
| 18UMEC100 | ES | Elements of Mechanical Engineering | 2 - 0 - 0 | 2 | 50 | 50 | 2 | - | - |
| 18UPHL100 | BS | Engineering Physics Lab | 0 - 0 - 2 | 1 | 50 | -- | -- | 50 | 3 |
| 18UESL100 | ES | Basic Engineering Skills Lab | 0 - 0 - 2 | 1 | 50 | -- | -- | 50 | 3 |
| 18UHUC100 | HU | Kannada | 2- 0 -0 | 1 | 50 | 50 | 2 | | |
| 18UHUA100 | HU | Constitution of India & Professional Ethics | 2- 0 - 0 | Audit | 100 | -- | -- | -- | -- |
| **Total** | | | **18 - 4 - 4** | **19** | **500** | **500** | | **100** | |

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## Chemistry cycle

| Course Code | Course Category | Course Title | Teaching | | Examination | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L-T-P (Hrs/Week) | Credits | CIE | Theory (SEE) | | Practical (SEE) | |
| | | | | | Max. Marks | *Max. Marks | Duration in Hrs. | Max. Marks | Duration In Hrs. |
| 18UMAC100 | BS | Engineering Mathematics-I | 3 - 2 - 0 | 4 | 50 | 100 | 3 | -- | -- |
| 18UCYC100 | BS | Engineering Chemistry | 3 - 2 - 0 | 4 | 50 | 100 | 3 | -- | -- |
| 18UECC100 | ES | Basic Electronics | 3 - 0 - 0 | 3 | 50 | 100 | 3 | -- | -- |
| 18UCSC100 | ES | Problem Solving & Programming in C | 3 - 2 - 0 | 4 | 50 | 100 | 3 | -- | -- |
| 18UMGC100 | ES | Engineering Graphics | 2 - 0 - 2 | 3 | 50 | 100 | 3 | -- | -- |
| 18UCYL100 | BS | Engineering Chemistry Lab | 0 - 0 - 2 | 1 | 50 | -- | -- | 50 | 3 |
| 18UCSL100 | ES | Problem Solving & Programming in C Lab | 0 - 0 - 2 | 1 | 50 | -- | -- | 50 | 3 |
| 18UHUC101 | HU | Functional English | 2 - 0 -0 | 1 | 50 | 50 | 2 | -- | -- |
| 18UHUA102 | HU | Environmental Science | 2 - 0 - 0 | Audit | 100 | -- | -- | -- | -- |
| **Total** | | | **18 - 6 - 6** | **21** | **500** | **550** | | **100** | |

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**III Semester**

| Course Code | Course Category | Course Title | Teaching | | Examination | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L-T-P (Hrs/Week) | Credits | CIE | Theory (SEE) | | Practical (SEE) | |
| | | | | | Max. Marks | *Max. Marks | Duration in Hrs. | Max. Marks | Duration In Hrs. |
| 18UMAC300 | BS | Engg. Mathematics-III | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSC300 | PC | Digital Electronics | **4-0-0** | 4 | 50 | 100 | 3 | - | - |
| 18UCSC301 | PC | Discrete Structures in Computer Science | **3-2-0** | 4 | 50 | 100 | 3 | - | - |
| 18UCSC302 | PC | Data Structures and Applications | **4-0-0** | 4 | 50 | 100 | 3 | - | - |
| 18UCSC303 | PC | Computer Organization and Architecture | **3-0-0** | 3 | 50 | 100 | 3 | -- | -- |
| 18UCSC304 | PC | Introduction to Unix Operating Systems | **2-0-2** | 3 | 50 | 100 | 3 | -- | -- |
| 18UCSL305 | PC | Digital Electronics Laboratory | **0-0-3** | 1.5 | 50 | -- | -- | 50 | 3 |
| 18UCSL306 | PC | Data Structures and Applications Laboratory | **0-0-3** | 1.5 | 50 | -- | -- | 50 | 3 |
| Total | | | **19-2-8** | **24** | **400** | **600** | **-** | **100** | **-** |

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**IV Semester**

| Course Code | Course Category | Course Title | Teaching | | Examination | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L-T-P (Hrs/Week) | Credits | CIE | Theory (SEE) | | Practical (SEE) | |
| | | | | | Max. Marks | *Max. Marks | Duration in Hrs. | Max. Marks | Duration In Hrs. |
| 18UMAC400 | BS | Engineering Mathematics-IV | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSC400 | PC | ARM Processor | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSC401 | PC | Finite Automata and Formal Languages | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSC402 | PC | Object Oriented Programming | **4-0-0** | 4 | 50 | 100 | 3 | - | - |
| 18UCSC403 | PC | Analysis and Design of Algorithms | **3-0-2** | 4 | 50 | 100 | 3 | - | - |
| 18UCSC404 | PC | Operating Systems | **4-0-0** | 4 | 50 | 100 | 3 | - | - |
| 18UCSL405 | PC | Object Oriented Programming Lab | **0-0-3** | 1.5 | 50 | -- | - | 50 | 3 |
| 18UCSL406 | PC | ARM Processor Lab | **0- 0-3** | 1.5 | 50 | -- | - | 50 | 3 |
| 18UCSL407 | PC | Introductory Project | **0–0-2** | 1 | 50 | -- | -- | -- | -- |
| Total | | | **20-0-10** | **25** | **450** | **600** | | **100** | |

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**V Semester**

| Course Code | Course Category | Course Title | Teaching | | Examination | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | CIE | Theory (SEE) | | Practical (SEE) | |
| | | | L-T-P (Hrs/Week) | Credits | Max. Marks | *Max. Marks | Duration in Hrs. | Max. Marks | Duration In Hrs. |
| 18UHUC500 | HU | Management, Entrepreneurship and IPR | **4-0-0** | 4 | 50 | 100 | 3 | - | - |
| 18UCSC500 | PC | Data Communication | **4-0-0** | 4 | 50 | 100 | 3 | - | - |
| 18UCSC501 | PC | Database Management Systems | **4-0-0** | 4 | 50 | 100 | 3 | - | - |
| 18UCSC502 | PC | Compiler Design and System Software | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSC503 | PC | Software Engineering | **3-0-0** | 3 | 50 | 100 | 3 | -- | -- |
| 18UCSL504 | PC | Database Management Systems Lab | **0-0-3** | 1.5 | 50 | -- | -- | 50 | 3 |
| 18UCSL505 | PC | Compiler Design and System Software Lab | **0- 0 -3** | 1.5 | 50 | -- | -- | 50 | 3 |
| 18UCSL506 | PC | Minor Project-1 | **0-0 – 2** | 1 | 50 | -- | -- | -- | -- |
| 18UHUL507 | HU | Soft skills/Aptitude | **0-0 – 2** | 1 | 50 | -- | -- | -- | -- |
| **Elective Courses (One elective is to be chosen by the students)** | | | | | | | | | |
| 18UCSE508 | PE | Advanced Object Oriented Programming | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSE509 | PE | System Simulation and Modeling | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSE510 | PE | Advanced Graph Theory | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| **Total** | | | **21-0-10** | **26** | **500** | **600** | | **100** | |

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**VI Semester**

| Course Code | Course Category | Course Title | Teaching | | Examination | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | CIE | Theory (SEE) | | Practical (SEE) | |
| | | | L-T-P (Hrs/Week) | Credits | Max. Marks | *Max. Marks | Duration in Hrs. | Max. Marks | Duration In Hrs. |
| 18UCSC600 | PC | Computer Networks | **4-0-0** | 4 | 50 | 100 | 3 | - | - |
| 18UCSC601 | PC | Object Oriented System Modeling and Design | **4-0-0** | 4 | 50 | 100 | 3 | - | - |
| 18UCSL602 | PC | Computer Networks Lab | **0-0-3** | 1.5 | 50 | - | - | 50 | 3 |
| 18UCSL603 | PC | Industry Oriented Programming Practices Lab | **0-0-3** | 1.5 | 50 | - | - | 50 | 3 |
| 18UCSL604 | PC | Minor Project-2 | **0-0-4** | 2 | 50 | - | - | 50 | 3 |
| 18UHUL605 | HU | Soft skills/Aptitude | **0-0-2** | 1 | 50 | - | - | - | - |
| **Elective Courses (Two Program Electives and One Open Elective are to be chosen by the students)** | | | | | | | | | |
| 18UCSE606 | PE | Unix Systems Programming | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSO607 | OE | Digital Image Processing | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSE608 | PE | Principles of Programming | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSE609 | PE | Data Mining | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSE610 | PE | Advanced Data Structures and Algorithms | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSE611 | PE | Pattern Recognition | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSO612 | OE | Embedded Systems | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| **Total** | | | **17 - 0 -12** | **23** | **450** | **500** | | **150** | |

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**VII Semester**

| Course Code | Course Category | Course Title | Teaching | | Examination | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L-T-P (Hrs/Week) | Credits | CIE | Theory (SEE) | | Practical (SEE) | |
| | | | | | Max. Marks | *Max. Marks | Duration (Hrs) | Max. Marks | Duration (Hrs) |
| 18UCSC700 | PC | Artificial Intelligence and Machine Learning | **4-0-0** | 4 | 50 | 100 | 3 | - | - |
| 18UCSC701 | PC | Advanced Computer Architecture | **4-0-0** | 4 | 50 | 100 | 3 | - | - |
| 18UCSL702 | PC | Artificial Intelligence and Machine Learning Lab | **0-0-2** | 1 | 50 | -- | -- | 50 | 3 |
| 18UCSL703 | PC | Major Project Phase-1 | **0- 0 -4** | 2 | 50 | -- | -- | 50 | 3 |
| 18UCSL704 | PC | Internship | **4weeks** | 2 | 50 | -- | -- | 50 | 3 |
| **Elective Courses (Two electives, one Program Elective and one Open Elective, are to be chosen by the students)** | | | | | | | | | |
| 18UCSE705 | PE | Computer Graphics | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSE706 | PE | Software Testing | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSO707 | OE | Web Technology | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSE708 | PE | Ad-hoc Networks | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSE709 | PE | Operations Research | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSE710 | PE | Multicore Architecture and Programming | **3-0-0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSE711 | OE | Internet of Things | **2-0-2** | 3 | 50 | 100 | 3 | - | - |
| **Total** | | | **14 - 0 - 6** | **19** | **350** | **400** | **-** | **150** | **-** |

**VIII Semester**

| Course Code | Course Category | Course Title | Teaching | | Examination | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L-T-P (Hrs/Week) | Credits | CIE | Theory (SEE) | | Practical (SEE) | |
| | | | | | Max. Marks | *Max. Marks | Duration (Hrs) | Max. Marks | Duration (Hrs) |
| 18UCSC800 | PC | Distributed Systems and Applications | **4 - 0 - 0** | 4 | 50 | 100 | 3 | - | - |
| 18UCSL801 | PC | Independent study | **0 - 0 - 2** | 1 | 50 | - | - | - | - |
| 18UCSL802 | PC | Major Project Phase – 2 | **0 -0 - 14** | 7 | 50 | - | - | 50 | 3 |
| **Elective Courses (Two electives, one Program Elective and one Open Elective, are to be chosen by the students)** | | | | | | | | | |
| 18UCSE803 | PE | Cryptography and Network Security | **3 - 0 - 0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSO804 | OE | Cloud Computing | **3 - 0 - 0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSE805 | PE | Network Management | **3 - 0 - 0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSE806 | PE | Mobile Applications Development | **3 -0 - 0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSE807 | PE | Ontology and Semantic Web | **3 - 0 - 0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSE808 | PE | Data Science | **3 - 0 - 0** | 3 | 50 | 100 | 3 | - | - |
| 18UCSE809 | PE | Blockchain Technology | **3 – 0 – 0** | 3 | 50 | 100 | 3 | - | - |
| **Total** | | | **10 – 0 – 16** | **18** | **250** | **300** | **--** | **50** | **--** |

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**Scheme-2018**

**Scheme of Teaching and Examination**
**I Semester M. Tech (CSE)**

| Course Code | Course Title | Teaching | | Examination | | | | |
|---|---|---|---|---|---|---|---|---|
| | | L-T-P (Hrs/Week) | Credits | CIE | Theory (SEE) | | Practical (SEE) | |
| | | | | Max. Marks | *Max. Marks | Duration in hours | Max. Marks | Duration in hours |
| 18PCSEC100 | Advanced database management systems | 4-0-0 | 4 | 50 | 100 | 3 | - | - |
| 18PCSEC101 | Advanced Algorithms | 4-0-0 | 4 | 50 | 100 | 3 | - | - |
| 18PCSEE1XX | Elective-I | 3-0-2 | 4 | 50 | 100 | 3 | - | - |
| 18PCSEE1XX | Elective-II | 3-0-2 | 4 | 50 | 100 | 3 | - | - |
| 18PCSEE1XX | Elective-III | 3-0-2 | 4 | 50 | 100 | 3 | - | - |
| 18PCSEL102 | Algorithms and Database Laboratory *** | 0-0-3 | 2 | 50 | - | - | 50 | 3 |
| 18PCSEL103 | Seminar – I ** | 0-0-3 | 1 | 100 | - | - | - | - |
| **Total** | | **17-0-12** | **23** | **400** | **500** | **-** | **50** | **3** |

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**Scheme of Teaching and Examination**
**II Semester M. Tech (CSE)**

| Course Code | Course Title | Teaching | | Examination | | | | |
|---|---|---|---|---|---|---|---|---|
| | | L-T-P (Hrs/Week) | Credits | CIE | Theory (SEE) | | Practical (SEE) | |
| | | | | Max. Marks | *Max. Marks | Duration in hours | Max. Marks | Duration in hours |
| 18PCSEC200 | Advanced Computer Networks | 4-0-0 | 4 | 50 | 100 | 3 | - | - |
| 18PCSEC201 | Advanced Operating Systems | 4-0-0 | 4 | 50 | 100 | 3 | - | - |
| 18PCSEE2XX | Elective – IV | 3-0-2 | 4 | 50 | 100 | 3 | - | - |
| 18PCSEE2XX | Elective – V | 3-0-2 | 4 | 50 | 100 | 3 | - | - |
| 18PCSEE2XX | Elective –VI | 3-0-2 | 4 | 50 | 100 | 3 | - | - |
| 18PCSEL202 | Operating System and Networks Laboratory *** | 0-0-3 | 2 | 50 | - | - | 50 | 3 |
| 18PCSEL203 | Seminar – II ** | 0-0-3 | 1 | 100 | - | - | - | - |
| **Total** | | **17-0-12** | **23** | **400** | **500** | **-** | 50 | **3** |

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**List of Electives**

| I Semester | | II Semester | |
|---|---|---|---|
| 18PCSEE125 | Research Methodologies& IPR | 18PCSEE225 | High Performance Computing |
| 18PCSEE126 | Distributed Systems | 18PCSEE226 | Data Science |
| 18PCSEE127 | Programming Paradigm | 18PCSEE227 | Machine Learning |
| 18PCSEE128 | Cloud Computing | 18PCSEE228 | Wireless Networks & Mobile Computing |
| 18PCSEE129 | Information and Network Security | 18PCSEE229 | Soft Computing |
| 18PCSEE130 | Image Processing, Analysis and Machine Vision | 18PCSEE230 | Computer Vision |
| 18PCSEE131 | Computer Graphics | 18PCSEE231 | Internet of Things |

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**Scheme of Teaching and Examination**
**III Semester M.Tech. (CSE)**

| Course Code | Course Title | Teaching | | Examination | | | | |
|---|---|---|---|---|---|---|---|---|
| | | L-T-P (Hrs/Week) | Credits | CIE | Theory (SEE) | | Practical (SEE) | |
| | | | | Max. Marks | *Max. Marks | Duration in hours | Max. Marks | Duration in hours |
| 18PCSEC300 | Advanced Computer Architecture | 4-0-0 | 4 | 50 | 100 | 3 | - | - |
| 18PCSEE3XX | Elective – VII | 3-0-2 | 4 | 50 | 100 | 3 | - | - |
| 18PCSEL301 / 18PCSEE3XX | Internship in Industry or R & D Organisation / Elective VIII | ** Min. 4 weeks during vacation after 2nd Sem / 3-0-0 | 3 | 50 / 50 | - / 100 | - / 3 | 50 / - | 3 / - |
| 18PCSEL302 | Project Work Phase – I*** | 0-0-15 | 9 | 50 | - | - | 50 | 3 |
| **Total** | | **8/11-0-17** | **20** | **200** | **200 / 300** | **-** | 100 / 50 | **3** |

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| Electives III | |
|---|---|
| 18PCSEE325 | Pattern Recognition |
| 18PCSEE326 | Software Engineering |
| 18PCSEE327 | Game Theory |
| 18PCSEE328 | Web Technology |
| 18PCSEE329 | Natural Language Processing and Text Mining |

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**Scheme of Teaching and Examination**
**IV Semester M.Tech. (CSE)**

| Course Code | Course Title | Teaching | | Examination | | | | |
|---|---|---|---|---|---|---|---|---|
| | | L-T-P (Hrs/Week) | Credits | CIE | Theory (SEE) | | Practical (SEE) | |
| | | | | Max. Marks | *Max. Marks | Duration in hours | Max. Marks | Duration in hours |
| 18PCSEL400 | Project Work Phase – II* | 0-0-20 | 22 | 100 | - | - | 100 | 3 |
| **Total** | | **0-0-20** | **22** | **100** | **-** | **-** | **100** | **3** |

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| 18UCSC302 | Data Structures and Applications | (4-0-0) 4 |
|---|---|---|

**Contact Hours: 52**

**Course Learning Objectives (CLOs):** This course focuses on the following learning perspectives:

- Working of various basic data structures and their implementation.
- Implementation issues of data structure in programming language.
- Selection of the appropriate data structure for solving a given problem.

**Course Outcomes (COs):**

| **Description of the Course Outcome:** At the end of the course the student will be able to: | | **Mapping to POs(1-12) / PSOs (13-16)** | | |
|---|---|---|---|---|
| | | **Substantial Level (3)** | **Moderate Level (2)** | **Slight Level (1)** |
| **CO-1** | **Write** programs to solve problems using Pointers and Structures/Unions. | - | 14 | 1,3,15,16 |
| **CO-2** | **Write** programs to solve problems using files. | - | 14 | 1,3,15,16 |
| **CO-3** | **Write** programs to solve simple problems using stack and **explain** its working principles. | - | 14 | 1,3,15,16 |
| **CO-4** | **Write** programs to solve problems using queue and **explain** its working principles. | - | 14 | 1,3,15,16 |
| **CO-5** | **Write** programs to solve problems using Linked Lists and **explain** its working principles. | - | 14 | 1,3,15,16 |
| **CO-6** | **Write** programs to solve problems using trees and **explain** its working principles. | - | 14 | 1,3,15,16 |
| **CO-7** | **Write** programs to solve problems using Hashing and **explain** its working principles. | - | 14 | 1,3,15,16 |

| **POs/PSOs** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mapping Level** | 1.0 | - | 1.0 | - | - | - | - | - | - | - | - | - | - | 2.0 | 1.0 | 1.0 |

**Pre-requisites:** Problem Solving skills and knowledge of Programming in C language.

**Contents:**

**Unit-I**

**Structures, unions and Pointers:** Motivation for using structures. Pointer, access data from memory through pointer, pointer to structures. Motivation for dynamic memory requirement. Realizing arrays using pointer and dynamic memory allocation. Importance of memory management during allocation and de-allocation of memory.

**10 Hrs**

**Unit-II**

**Stack:** Realization of stack and its operations using static and dynamic structures. Application of stack in converting an expression from infix to postfix and evaluating a postfix expression. Heterogeneous stack using Unions. Applications of Stacks. **10 Hrs**

**Unit-III**

**Queues:** Realization of queues (FIFO, Double-ended queue, Priority queue) and its operations using static and dynamic data structures, Applications of Queues. **10 Hrs**

**Unit-IV**

**Lists:** Constructing dynamic data structures using self-referential structure (using the same realized linked Lists), operations on lists. Doubly Linked list. Application of Lists in sorting. **12 Hrs**

**Unit-V**

**Trees:** Types of trees and their properties, Realization of trees using static and dynamic data structures. Operations on Binary trees and their application in searching (BST and AVL Tree), Binary heap as priority queues, Applications of Trees.

**Hash Table:** Realizing effective hash table with proper data stricture and hash function, its application. **10 Hrs**

**Reference Books:**


1) Aaron M. Tenenbaum, Yedidyah Langsam & Moshe J. Augenstein, "Data Structures using C and C++", Pearson Education, 2006
2) E. Balagurusamy, "Programming in ANSI C", 7th Edition, Tata McGraw-Hill, 2016
3) Behrouz A. Forouzan & Richard F. Gilberg, "Computer Science: A Structured Programming Approach Using C", 2nd Edition, Cengage Learning, 2003.


## 18UCSC303 Computer Organization and Architecture (3-0-0) 3

**Contact Hours: 39**

**Course Learning Objectives (CLOs):** This course focuses on the following learning perspectives:

- Basics of sub systems of a computer, their organization, structure and operation.
- Basic concept of programs as sequences of machine instructions.

- Operational aspects of I/O devices and standard I/O interfaces.
- Memory hierarchy and concept of virtual memory.
- Arithmetic and logical operations with integer and floating-point operands.
- Organization of a simple processor, pipelined processor and other computing systems.

**Course Outcomes (COs):**

| **Description of the Course Outcome:** At the end of the course the student will be able to: | | **Mapping to POs(1-12) / PSOs (13-16)** | | |
|---|---|---|---|---|
| | | **Substantial Level (3)** | **Moderate Level (2)** | **Slight Level (1)** |
| **CO-1** | **Explain** the basic working principles of various sub-systems of a computer system. | - | - | 1,2,8 |
| **CO-2** | **Explain** the working principles of different sub systems, such as processor, Input/output, and memory. | - | 3,8 | 1,2,4,6 |
| **CO-3** | **Design** the required memory bank using basic memory units. | - | 3 | - |
| **CO-4** | **Explain** hardwired control and micro programmed control, pipelining, embedded and other computing systems. | 3,4 | 1 | 2 |
| **CO-5** | **Design** simple arithmetic and logical units for a given operational features. | 4,8 | 1,2,3 | - |

| **POs/PSOs** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mapping Level** | 1.5 | 1.3 | 2.3 | 2.3 | - | 1.0 | - | 2.0 | - | - | - | - | - | - | - | - |

**Pre-requisites:** Knowledge of Digital Electronics and Programming language.

**Contents:**

**Unit-I**

**Basic Structure and Machine Instructions:** Basic Operational Concepts, Bus Structures, Performance - Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.

**Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly

Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions. **8 Hrs**

**Unit-II**

**Input / Output Organization:** Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces – PCIBus, SCSI Bus, USB. **8 Hrs**

**Unit-III**

**Memory System:** Basic Concepts, Semiconductor RAM and ROM Memories, Speed, Size and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations. **8 Hrs**

**Unit-IV**

**Arithmetic:** Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations. **8 Hrs**

**Unit-V**

**Basic Processing Unit:** Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. Pipelining, Embedded Systems and Large Computer Systems: Basic Concepts of pipelining, Examples of Embedded Systems, Processor chips for embedded applications, Simple Microcontroller. **7 Hrs**

**Reference Books:**


1) Carl Hamacher, Zvonko Vranesic & SafwatZaky, “Computer Organization”, 5th Edition, Tata Mc Graw Hill, 2011.
2) William Stallings, “Computer Organization & Architecture”, 9th Edition, Prentice Hall of India, 2012.
3) Vincent P. Heuring & Harry F. Jordan, “Computer Systems Design and Architecture”, 2nd Edition, Pearson education, 2004.


**18UCSL306 Data Structues and Applications Laboratory (0-0-3) 1.5**

**Contact Hours: 36**

**Course Learning Objectives (CLOs):** This laboratory course focuses on the following learning perspectives:

- Realization of fundamental data structures like stacks, queues, linked lists and trees.
- Compare and contrast the benefits of dynamic and static data structure implementations.
- Selection of the appropriate data structure for solving a given problem.

**Course Outcomes (COs):**

| **Description of the Course Outcome:** At the end of the course the student will be able to: | | **Mapping to POs(1-12) / PSOs (13-16)** | | |
|---|---|---|---|---|
| | | **Substantial Level (3)** | **Moderate Level (2)** | **Slight Level (1)** |
| **CO-1** | **Write** programs to solve problems using Pointers and Structures/Unions. | - | 14 | 1,3, 15, 16 |
| **CO-2** | **Write** programs to solve problems using files. | - | 14 | 1,3, 15, 16 |
| **CO-3** | **Write** programs to solve problems using stack. | - | 14 | 1,3, 15, 16 |
| **CO-4** | **Write** programs to solve problems using queue. | - | 14 | 1,3, 15, 16 |
| **CO-5** | **Write** programs to solve problems using Linked Lists. | - | 14 | 1,3, 15, 16 |
| **CO-6** | **Write** programs to solve problems using trees. | - | 14 | 1,3, 15, 16 |
| **CO-7** | **Write** programs to solve problems using Hashing. | - | 14 | 1,3, 15, 16 |

| **POs** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mapping Level** | 1.0 | - | 1.0 | - | - | - | - | - | - | - | - | - | - | 2.0 | 1.0 | 1.0 |

**Suggested list of term works:**

The list of experiments is based on the following concepts:

1. Pointers and Structures / Unions.
2. Files
3. Stack
4. Queue
5. Linked Lists
6. Trees
7. Hashing

**Reference Books:**


1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein: Data Structures using C and C ++, Pearson Education / PHI, 2006,
2. E. Balagurusamy: Programming in ANSI C, 7th Edition, Tata McGraw-Hill, 2016.
3. Behrouz A. Forouzan and Richard F. Gilberg: Computer Science: A Structured Programming Approach Using C, 2nd Edition, Ceng


## IV Semester

| 18UCSC400 | ARM Processor | (3-0-0) 3 |
|---|---|---|

**Contact Hours: 39**

**Course Learning Objectives (CLOs):** This course focuses on the following learning perspectives:

- Understand the internal architecture, instruction set of ARM7 microcontroller, assembling process & implement small programs.
- Design & develop Assembly Language Program /& C program for a given real time application.
- Understand the use of interrupts & other advanced concepts related to ARM7
- Demonstrate working knowledge of the necessary steps and methods used to interface ARM7 to devices such as motors, LCD, ADC, and DAC etc.

**Course Outcomes (COs):**

| **Description of the Course Outcome:** At the end of the course the student will be able to: | | **Mapping to POs(1-12) / PSOs (13-16)** | | |
|---|---|---|---|---|
| | | **Substantial Level (3)** | **Moderate Level (2)** | **Slight Level (1)** |
| **CO-1** | **Explain** the features of embedded systems, architecture of ARM7 and applications. | - | 1 | - |
| **CO-2** | **Write** a program using the instruction set of ARM and THUMB state to solve the engineering problems. | - | 2,5 | 13 |
| **CO-3** | **Explain** the exception, interrupts and interrupt handling schemes and **write** program to solve simple problems. | - | 3 | - |
| **CO-4** | **Explain** the architectural features of LPC2148 microcontrollers. | - | 1,2 | 13,15 |

| | | | | |
|---|---|---|---|---|
| **CO-5** | **Write** a program to interface hardware to LPC2148 microcontrollers. | - | 5 | 3,12 |

| POs/PSOs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mapping Level | 2.0 | 2.0 | 1.5 | - | 2.0 | - | - | - | - | - | - | 1.0 | 1.0 | - | 1.0 | - |

**Pre-requisites:** None

**Contents:**

**Unit-I**

**ARM Embedded Systems and ARM Processor Fundamentals:** Evolution of Microcontroller and Microprocessor, The RISC design philosophy, ARM design philosophy, embedded system hardware- AMBA bus protocol, embedded system software- applications. ARM core data flow model, Registers, CPSR-Processor modes, Banked registers. Pipeline- Characteristics. **9 Hrs**

**Unit-II**

**ARM Instruction Set:** Fundamentals of ARM instructions, Barrel shifter, Classification and explanation of instructions with examples-Data processing, Branch, Load-store, SWI and Program Status. **7 Hrs**

**Unit-III**

**Introduction to THUMB and ARM Programming:** Introduction to THUMB, Differences between ARM and THUMB, Register usage in Thumb, ARM Thumb Interworking. General Structure of ARM assembly module, Assembler directives. Simple ALP programs on Arithmetic & logical operations, Factorial, string operation, sorting, searching, and Scan. **8 Hrs**

**Unit-IV**

**Exception and Interrupt handling schemes:** Exception handling- ARM processor exceptions and modes, vector table, exception priorities, link register offsets. Interrupts- assigning interrupts, interrupt latency, IRQ and FIQ exceptions with example- code for enabling and disabling IRQ and FIQ exceptions, Comparison between exception and interrupts. Interrupt handling schemes- nested interrupt handler, non-nested interrupt handler. Basic interrupt stack design. **7 Hrs**

**Unit-V**

**LPC2148 ARM CPU:** Salient features, applications, block diagram, memory mapping. Functional features of Interrupt controller, RTC, USB, UART, I2C, SPI, SSP controllers, watch dog timers and other system control units.

**Peripherals - GPIO, PLL & Timers:** Features, Register description with example and Applications. **8 Hrs**

**Reference Books:**


1) Andrew N. Sloss, ARM System Developer's guide, ELSEVIER Publications, 2016
2) William Hohl, ARM Assembly Language, CRC Press.
3) Steve Furber, ARM System-on-chip Architecture by, Pearson Education, 2012
4) James K. Peckol, Embedded Systems: A Contemporary Design Tool, 2008
5) Jonathan W. Valvano, Brookes / Cole, Embedded Microcomputer Systems, Real Time Interfacing, 1999
6) LPC 2148 USER MANUAL.


## 18UCSL406 ARM Processor Laboratory (0-0-3) 1.5

**Contact Hours: 36**

**Course Learning Objectives (CLOs):** This laboratory course focuses on the following learning perspectives:

- Understand the internal architecture, instruction set of ARM7 microcontroller, assembling process & implement small programs.
- Design & develop Assembly Language Program /& C program for a given real time application.
- Understand the use of interrupts & other advanced concepts related to ARM7
- Demonstrate working knowledge of the necessary steps and methods used to interface ARM7 to devices such as motors, LCD, ADC, and DAC etc.

**Course Outcomes (COs):**

| **Description of the Course Outcome:** At the end of the course the student will be able to: | | **Mapping to POs(1-12) / PSOs (13-16)** | | |
|---|---|---|---|---|
| | | **Substantial Level (3)** | **Moderate Level (2)** | **Slight Level (1)** |
| **CO-1** | **Execute** assembly level codes for a given specific problem using ARM processor. | - | 2, 4 | 3,15 |
| **CO-2** | **Execute** embedded C programs for a given specific problem using ARM processor. | - | 4,14 | 15,16 |
| **CO-3** | **Implement** programs for interfacing with real world devices such as LCD's Keyboards, DAC, ADC, Relays Motors etc. | 13 | 4,5,16 | 3,12 |

| **POs/PSOs** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mapping Level** | - | 2.0 | 1.0 | 2.0 | 2.0 | - | - | - | - | - | - | 1.0 | 3.0 | 2.0 | 1.0 | 1.5 |

**Course Contents:**

**PART A:** Conduct the following experiments to learn ALP using ARM:

- Arithmetic and logical operations
- Interrupts related operations
- Timer related applications.

**PART B:** Conduct interfacing experiments to learn embedded C for ARM:

- LCD- interfacing
- Stepper Motor Interfacing
- Real time sensors Interfacing
- 7-segment LED interface

**Reference Books:**


1. Andrew N. Sloss, ARM System Developer's guide, ELSEVIER Publications, 2016
2. William Hohl, ARM Assembly Language, CRC Press.
3. Steve Furber, ARM System-on-chip Architecture by, Pearson Education, 2012
4. James K. Peckol, Embedded Systems: A Contemporary Design Tool, 2008
5. Jonathan W. Valvano, Brookes / Cole, Embedded Microcomputer Systems, Real Time Interfacing, 1999
6. LPC 2148 USER MANUAL.


| **18UCSL407** | **Introductory Project** | **(0-0-2) 1** |
|---|---|---|

**Contact Hours: 24**

**Course Learning Objectives (CLOs):** This course enables the student to identify the community expectations in terms of possible engineering solutions and prepare project proposal.

**Course Outcomes (COs):**

| **Description of the Course Outcome:** At the end of the course the student will be able to: | | **Mapping to POs(1-12) / PSOs (13-16)** | | |
|---|---|---|---|---|
| | | **Substantial Level (3)** | **Moderate Level (2)** | **Slight Level (1)** |
| **CO-1** | **Identify** the societal problems | - | - | 2,6,7,9,12,13 |
| **CO-2** | **Analyze** real environment and **Formulate** the problem statement. | - | - | 9,12,13 |

| | | | | |
|---|---|---|---|---|
| **CO-3** | **Conduct** exhaustive literature survey | - | - | 9,12,13 |
| **CO-4** | **Propose** sustainable engineering solutions | - | - | 5,7,12,13 |
| **CO-5** | **Prepare** the report and communicate effectively through presentation. | - | - | 9,10,12,13 |
| **CO-6** | **Manage** the project in terms of various resources in a particular discipline or in a multi-disciplinary domain. | - | - | 11 |

| **POs** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mapping Level** | - | 1.0 | - | - | 1.0 | 1.0 | 1.0 | - | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | - | - | - |

Guidelines for conduction:

1. Team consists of 4-5 students.
2. Students have to choose a guide among the faculty members who are teaching their semester.
3. In consultation with guide, the team should carry out their project work.
4. Final evaluation is based on seminar and report submission.
5. This requires designated committee to monitor the process of conduction

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Date: 2023-05-16 08:47+05:30

## V Semester

| 18UHUC500 | Management, Enterprenuership, and IPR | (4-0-0) 4 |
|---|---|---|

**Contact Hours: 52**

**Course Learning Objectives (CLOs):** This course focuses on the following learning perspectives:

- The evolution of IT managementand related aspects.
- The scope of entrepreneurship in digital firms.
- The issues and procedures related to intellectual property rights.

.

**Course Outcomes (COs):**

| **Description of the Course Outcome:** At the end of the course the student will be able to: | | **Mapping to POs(1-12)/ PSOs (13-16)** | | |
|---|---|---|---|---|
| | | **Substantial Level (3)** | **Moderate Level (2)** | **Slight Level (1)** |
| **CO-1** | **Study** the principles of management in a given organization. | - | 2 | - |
| **CO-2** | **Describe** and **analyze** the role of staffing and the need for motivation in management | - | 2 | - |
| **CO-3** | **Explain** the role of entrepreneur in establishing an organization. | - | 2,6 | - |
| **CO-4** | **Describe** the importance and provisions of institutional support in establishing an enterprise. | - | 2,6 | - |
| **CO-5** | **Explain** the core principles, procedures and related laws and **apply** IPR for given new idea/invention. | - | 5,8,10 | - |

| **POs/PSOs** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mapping Level** | - | 2.0 | - | - | 2.0 | 2.0 | - | 2.0 | - | 2.0 | - | - | - | - | - | - |

**Pre-requisites:** Knowledge of humanities course.

**Contents:**

**Unit-I**

**Engineering and Management:** Historical Development of Engineering and Management, Management as synthesis.

Planning, Forecasting and Decision Making: Nature of Planning, foundation of planning, some planning concepts, forecasting, nature of decision making, management science, tools for decision **10Hrs**

**Unit-II**

**Organizing and staffing:** Nature of organizing, traditional organizational theory, technology and modern organization structures, staffing technical organization, authority and power; delegation, meeting and committees. Motivation: Motivation, leadership, motivating and leading technical professionals. Controlling: Process of control, financial and non-financial controls. **11 Hrs**

**Unit-III**

**Foundations of Entrepreneurship:** Meaning of entrepreneur, functions of entrepreneur, types of entrepreneur, concept of entrepreneurship, role of entrepreneurs in economic development& barriers of entrepreneurship. Small Scale Industry: Definition, characteristics of SSI, role of SSI in economic development, advantages of SSI, steps to start an SSI, impact of liberalization, privatization, and globalization on SSI, definition of ancillary and tiny industry. **11 Hrs**

**Unit-IV**

**Government and Institutional Support:** Nature of support from government, objectives and functions of SSI, SIDBI, DIC, single window agency, KIADB, KSSIDC, KSFC. Preparation of Project: Meaning of project identification, project report, contents and formulation, identification of business opportunities, feasibility studies, types and purpose. **10 Hrs**

**Unit-V**

**Intellectual Property Rights:** Meaning and forms of intellectual property rights, competing rationale for protection, international conventions and security. Copyright: Meaning of copyright, content of copy right, ownership and rights, period of copyright, assignment and relinquishment of copyright, license, infringement of copy right, fair use, offenses and penalties. Patents: Concept of patent, patentable inventions, procedure for obtaining patent, rights and obligations of patent holders, infringements and remedies, offenses and penalties. Industrial Designs: Definition of design, procedure for registration, rights conferred by registration, infringements, Trademark and related issues. **10 Hrs**

**Reference Books:**


1) Kenneth C. Laudon and Jane P. Laudon, “Management Information Systems - Managing the Digital Firm”, 8th Edition, Pearson Publications, 2017.
2) Making Intellectual Property Work for Business - Handbook for Chambers of Commerce and Business Associations Setting Up Intellectual Property Services by ICC and WIPO, Paperback, 2012.

| 18UCSC502 | Compiler Design and System Software | (3-0-0) 3 |
|---|---|---|

**Contact Hours: 39**

**Course Learning Objectives (CLOs):** This is a 3 credit course at undergraduate level enabling the students to understand structure of a compiler,representation of patterns and syntax using lexical rules and grammars respectively, working of parsers, translation schemes, code optimization and code generation, working of assemblers, loaders, linkers and macro processor.

**Course Outcomes (COs):**

| **Description of the Course Outcome:** At the end of the course the student will be able to: | | **Mapping to POs(1-12)/ PSOs (13-16)** | | |
|---|---|---|---|---|
| | | **Substantial Level (3)** | **Moderate Level (2)** | **Slight Level (1)** |
| **CO-1** | **Explain** the basic structure and working principles of phases of compiler. | - | 13 | 1 |
| **CO-2** | **Write** a parser for the given input based on the appropriate parsing technique and **validate** the design | 13,14 | 1,2,3 | 15 |
| **CO-3** | **Generate** an optimized intermediate code. | - | 1,2,3,13 | 15 |
| **CO-4** | **Explain** the working principles of run time environments that include stack allocation, heap management and garbage collection technique used in compiler. | - | 1,2,3,13 | 15 |
| **CO-5** | **Generate** optimized code for the given intermediate code | - | 1,2,3,13 | 15 |
| **CO-6** | **Design** Assembler for the given language specification and **validate** the design. | - | 1,2,3,13,14 | 15 |
| **CO-7** | **Design** Macroprocessor for the given language specification and **validate** the design. | - | 1,2,3,13,14 | 15 |

| | | | | |
|---|---|---|---|---|
| **CO-8** | **Explain** the working principles of Linkers & Loaders for the given language specification. | - | 1,2,3,13,14 | 15 |

| POs/PSOs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mapping Level | 1.9 | 2.0 | 2.0 | - | - | - | - | - | - | - | - | - | 2.1 | 2.3 | 1.0 | - |

**Pre-requisites:** Knowledge of

- Finite Automata and Formal languages
- Programming language (any)

**Contents:**

**Unit-I**

**Introduction:** Different Phases of Compilers, Comparison of Compilers and Interpreters. Top-down Parsing: RDP and Predictive parsing. **7 Hrs**

**Unit-II**

**Bottom-up Parsing:** Simple LR, LALR, CLR, parsers ambiguous grammars. **8 Hrs**

**Unit-III**

**Intermediate Code Generation and Optimizations:** Syntax-directed translation; Syntax-directed translation schemes, Variants of syntax trees; Three-address code; Types and declarations; Translation of expressions; Type checking; Control flow; Various techniques of machine independent optimization. **8 Hrs**

**Unit-IV**

**Run-Time Environments:** Storage Organization; Stack allocation of space; Access to non-local data on the stack; Heap management; Introduction to garbage collection.
**Code Generation:** Issues in the design of Code Generator; The Target language; Addresses in the target code; Basic blocks and Flow graphs; Optimization of basic blocks; A Simple Code Generator **8 Hrs**

**Unit-V**

**Ancillary Code Processing Techniques:** Generic description of Assembler, Loader, Linker and Macro's. Assemblers: Basic Assembler Features & Functions and Design of assembler. Loaders and Linkers: Basic Loader Functions - Design of Loaders and Linkers Macro Processor: Design of Macro Processors. **8 Hrs**

**Reference Books:**


1) Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman,"Compilers- Principles, Techniques and Tools", 2/E, Addison-Wesley, 2007.
2) D.M.Dhamdhere, "System Programming and Operating Systems", 2nd revised edition, Tata McGraw - Hill, 2009 reprint.
3) Leland L Beck, "System Software : An Introduction to Systems Programming" 3rd Edition Pearson Education 2007
4) John J Donovan, "System Programming", Tata McGraw-Hill 2017


## 18UCSL505 Compiler Design and System Software Lab (0-0-3)1.5

**Contact Hours: 36**

**Course Learning Objectives (CLOs):** This laboratory course focuses on representation of patterns and syntax using lexical rules and grammars respectively, Implementation of parser & translation schemes, Implementation of assemblers, loaders, linkers & macro processor, Knowledge of system level APIs for implementation of IPC and system commands.

**Course outcomes (COs):**

| **Description of the Course Outcome:** At the end of the course the student will be able to: | | **Mapping to POs(1-12)/ PSOs (13-16)** | | |
|---|---|---|---|---|
| | | **Substantial Level (3)** | **Moderate Level (2)** | **Slight Level (1)** |
| **CO-1** | **Prepare** the grammar for the given constructs and **Write** a program using compiler writing tools to implement lexical analyzer and parser. | 13,14 | 1,2,3 | 15 |
| **CO-2** | **Write** a program to **implement** a parser. | 13,14 | 1,2,3 | 15 |
| **CO-3** | **Write** a program to implement assembler functions. | 13,14 | 1,2,3 | 15 |
| **CO-4** | **Write** a program to **Implement** various UNIX commands using system calls. | 13,14 | 1,2,3 | 15 |
| **CO-5** | **Use** IPC concepts in implementing communication protocol. | 13,14 | 1,2,3 | 15 |

| **POs/PSOs** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mapping Level** | 2.0 | 2.0 | 2.0 | - | - | - | - | - | - | - | - | - | 3.0 | 3.0 | 1.0 | - |

**Prerequisites:** Knowledge of: Unix Operating System, Any programming language, and Finite automata and formal Languages

**Contents:**

1. Programs on Lex and Yacc.
2. Implementation of parser.
3. Implementation of assembler.
4. Emulation of basic commands of UNIX using system calls.
5. Application development using Inter Process Communication.

| 18UCSL506 | Minor Project - 1 | (0-0-2)1 |
|---|---|---|

**Contact Hours: 24**

**Course Learning Objectives (CLOs):** This course enables the student to identify the community expectations in terms of possible engineering solutions and prepare project proposal.

**Course Outcomes (COs):**

| **Description of the Course Outcome:** At the end of the course the student will be able to: | | **Mapping to POs(1-12) / PSOs (13-16)** | | |
|---|---|---|---|---|
| | | **Substantial Level (3)** | **Moderate Level (2)** | **Slight Level (1)** |
| **CO-1** | **Identify** the societal problems. | - | 2,6,7,9,12,13 | - |
| **CO-2** | **Analyze** real environment and **Formulate** the problem statement. | - | 2,9,12,13 | - |
| **CO-3** | **Conduct** exhaustive literature survey | - | 2, 9,12,13 | - |
| **CO-4** | **Propose** sustainable engineering solutions / prototypes. | - | 3,5,7,12,13 | - |
| **CO-5** | **Prepare** the report and communicate effectively through presentation. | - | 8,9,10,12 | - |
| **CO-6** | **Manage** the project in terms of various resources in a particular discipline or in a multi-disciplinary domain. | - | 11 | - |

| **POs** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mapping Level** | - | 2.0 | 2.0 | - | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | - | - | - |

Guidelines for conduction:

1. Team consists of 4-5 students.
2. In consultation with guide, the team should carry out their project work.
3. Final evaluation is based on following evidence will be looked into and accordingly rubrics will be developed, such as problem statement, design, prototype/part of implementation, use of standard tools and techniques for testing and validation procedure.
4. This requires designated committee to monitor the process of conduction

| 18UHUL507 | Soft Skills / Aptitude | (0-0-2) 1 |
|---|---|---|

**Contact Hours: 24**

**Course Learning Objectives (CLOs):**

This is included with the objectives of improving the communication skills, proficiency in English language and aptitude ability of the student to enhance the employability.

**Course Outcomes (COs):**

| **Description of the Course Outcome:** At the end of the course the student will be able to: | | **Mapping to POs(1-12) / PSO(13-16)** | | |
|---|---|---|---|---|
| | | **Substantial Level (3)** | **Moderate Level (2)** | **Slight Level (1)** |
| CO-1 | **Explain** the significance of communication in the profession. | - | 10 | - |
| CO-2 | **Use** the English language with proficiency | - | 10 | 12 |
| CO-3 | **Solve** Aptitude related problems | - | 9 | 12 |
| CO-4 | **Demonstrate** the competency in the placement activities. | - | 9 | - |

| POs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mapping Level | - | - | - | - | - | - | - | - | 2.0 | 2.0 | - | 1.0 | - | - | - | - |

**Contents:**

Training on communication skills, proficiency in English language and aptitude ability involving the internal and external resource.

**Evaluation:**

Both the internal and external resource persons shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 25 marks in Aptitude testing and there shall be one presentation by the student for 25 marks or any other suitable testing components. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

## VI Semester

## ELECTIVES

| 18UCSE606 | UNIX Systems Programming | (3-0-0) 3 |
|---|---|---|

**Contact Hours: 39**

**Course Learning Objectives (CLOs):** This course facilitates the students to get familiarity with system calls, UNIX kernel structure and use of standards like ANSI and POSIX in programming.

**Course Outcomes (COs):**

| **Description of the Course Outcome:** At the end of the course the student will be able to: | | **Mapping to POs(1-12)/ PSOs (13-16)** | | |
|---|---|---|---|---|
| | | **Substantial Level (3)** | **Moderate Level (2)** | **Slight Level (1)** |
| **CO-1** | **Describe** the ANSI and POSIX standards used in UNIX operating system and programming | - | 1 | 13 |
| **CO-2** | **Explain** the UNIX file types and **demonstrate** the use of UNIX file APIs in programming. | 13,14 | 1,2,3 | 15 |
| **CO-3** | **Identify** the process management activities of UNIX and **write** programs that make use of processes and their environment. | 13,14 | 1,2,3 | 15 |
| **CO-4** | **Describe** the use of signals in UNIX and **illustrate** the use of signals in programs. | 13,14 | 1,2,3 | 15 |
| **CO-5** | **Explain** the need of daemons in UNIX and **identify** the use of daemons in UNIX OS. | 13,14 | 1,2,3 | 15 |
| **CO-6** | **Explain** inter process communication mechanisms of UNIX and **write** programs to | 13,14 | 1,2,3 | 15 |

| | | | | |
|---|---|---|---|---|
| | demonstrate IPCs for client-server interactions. | | | |
| **CO-7** | **Describe** the ANSI and POSIX standards used in UNIX operating system and programming. | - | 1 | 13 |

| POs/PSOs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mapping Level | 2.0 | 2.0 | 2.0 | - | - | - | - | - | - | - | - | - | 2.4 | 3.0 | 1.0 | - |

**Pre-requisites:** Knowledge of

- UNIX operating system and its commands
- Operating Systems Fundamentals
- Basics of Networking

**Contents:**

**Unit-I**

**ANSI and POSIX Standards:** UNIX and ANSI Standards – ANSI C standard, POSIX standards, POSIX environment, POSIX feature test macros, limits checking at compile time and run time; UNIX and POSIX APIs – POSIX APIs, UNIX and POSIX development environment, API common characteristics

**UNIX Files:** file types, UNIX and POSIX file systems, UNIX and POSIX file attributes, inodes in UNIX system V, UNIX kernel support for files, directory files, hard and symbolic links. **7 Hrs**

**Unit-II**

**UNIX File APIs:** General file APIs, open, read, write, close, fcntl, lseek, link, unlink, stat, fstat, lstat, access, chmod, fchmod, chown, fchown, lchown, utime, file and record locking, directory file APIs, device file APIs, FIFO file APIs, symbolic link file APIs.

**7 Hrs**

**Unit-III**

**Environment of a UNIX Process:** Introduction, main function, process termination, command line arguments, environment list, memory layout of a C program, alloca function, environment variables, setjmp and lonjmp functions, getrlimit and setrlimit functions

**Process Control:** Introduction, process identifiers, fork function, vfork function, exit functions, wait and waitpid functions, race conditions, exec functions, changing user IDs and group IDs, system function. **9 Hrs**

**Unit-IV**

**Process Relationships:** Introduction, terminal logins, network logins, process groups, sessions, controlling terminal, job control

**Signals and Daemon Processes:** Signals – UNIX kernel support for signals, signal, signal mask, sigaction, sigsetjmp and siglongjmp APIs, kill, alarm, interval timers;

Daemon Processes – introduction, daemon characteristics, coding rules, error logging, client-server model. **9 Hrs**

**Unit-V**

**Interprocess Communication:** Introduction, pipes, message queues, UNIX APIs for message queues, client-server example for message queue, sockets, socket APIs, client-server example for socket. **7 Hrs**

**Reference Books:**


**1)** Terrence Chan, "UNIX System programming using C++",Prentice Hall India, 2015

**2)** W. Richard Stevens, "Advanced Programming in the UNIX environment", Pearson Education/ PHI, 2005

**3)** Kay A Robbins & Steven Robbins, "Unix Systems Programming: Communication, Concurrency, and Threads", Prentice Hall Publications, 2003.


## VII SEMESTER

**18UCSC700 Artificial Intelligence and Machine Learning (4-0-0) 4**

**Contact Hours: 52**

**Course Learning Objectives (CLOs):** This course focuses on following learning perspectives:

- To introduce the basic concepts, theories and state-of-the-art techniques of artificial intelligence and machine learning.
- Enable student with knowledge enough to be a self-learner in exploring the application of machine learning /AI algorithms in the different fields of science, medicine, finance etc.

**Course Outcomes (COs):**

| **Description of the Course Outcome:** At the end of the course the student will be able to: | | **Mapping to POs(1-12)/ PSOs (13-16)** | | |
|---|---|---|---|---|
| | | **Substantial Level (3)** | **Moderate Level (2)** | **Slight Level (1)** |
| **CO-1** | **Explain** the world, behavior of agents and problem-solving aspects of agents. | - | 3,4 | 1,2 |
| **CO-2** | **Demonstrate** the representation and usage of knowledge using First order logic. | - | 3,4 | 1,2 |
| **CO-3** | **Explain** the decision-making process with incomplete, inconsistent and everchanging facts. | - | 3,4 | - |
| **CO-4** | **Explain** machine learning concepts and range of problems that can be handled by machine learning. | - | 3,4 | - |

| | | | | |
|---|---|---|---|---|
| **CO-5** | **Apply** the concepts of and the machine learning to the real-world problems. | - | - | 3,4,5 |

| POs/PSOs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mapping Level | 1.0 | 1.0 | 2.0 | 2.0 | 2.0 | - | - | - | - | - | - | - | - | - | - | - |

**Pre-requisites:** Knowledge of

1. Logic
2. Discrete Mathematics
3. Programming Fundamentals

**Contents:**

**Unit-I**

**Introduction:** AI Problems Underlying Assumption, AI Techniques, Criteria for Success
**State Space Search & Heuristic Search Techniques:** Defining the Problems as A State Space Search, Production Systems, Production Characteristics, Issues in The Design Of Search Programs.
**Generate And-Test:** Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, and Means-ends Analysis. **11 Hrs**

**Unit-II**

**Knowledge Representation:** Issues, Representations and Mappings, Approaches to Knowledge Representation.
**Using Predicate Logic:** Representation Simple Facts in Logic, Representing, Computable Functions and Predicates, Resolution. Representing Knowledge Using Rules, Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning. **11 Hrs**

**Unit-III**

**Statistical Reasoning, Probability and Uncertainty:** Bayes' Theorem, Full joint probabilistic distribution, Bayesian Networks and Probabilistic inferences, Dumpster Shafer Theory.
**Forms of learning:** Issues in designing a learning system. Assumptions of Common Machine Learning Models. **10 Hrs**

**Unit-IV**

**Linear Regression:** Multivariate Regression, Logistic regression, Polynomial Regression.
**Linear Models for Classification:** Decision Trees, Regression Trees, K-nearest neighbors (KNN) algorithm. Bias Variance Trade off. **10 Hrs**

**Unit-V**

**Perceptron:** Neural Networks - Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation, Support Vector Machines, Introduction, Early Models, Unsupervised learning and clustering – k-means clustering, hierarchical clustering. **10 Hrs**

**Reference Books:**


1) Elaine Rich and Kevin Knight "Artificial Intelligence", 2nd Edition, Tata Mcgraw-Hill, 2005.
2) Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall, 2009.
3) Trevor Hastie, Robert Tibshirani, and Jerome H. Friedman "The Elements of Statistical Learning".
4) Christopher Bishop, "Pattern Recognition and Machine Learning"
5) Mitchell Tom "Machine Learning", McGraw Hill, 1997.


| 18UCSL702 | Artificial Intelligence and Machine Learning Laboratory | (0-0-2) 1 |
|---|---|---|

**Contact Hours: 26**

**Course Learning Objectives (CLOs):** This course is in line with the theory course Artificial Intelligence & Machine Learning (18UCSC700). It focuses on hands on experience on creation of data models, database design, programming using appropriate technology.

**Course Outcomes (COs):**

| **Description of the Course Outcome:** At the end of the course, the student will be able to: | | **Mapping to POs(1-12) / PSOs(13-16)** | | |
|---|---|---|---|---|
| | | **Substantial Level (3)** | **Moderate Level (2)** | **Slight Level (1)** |
| **CO-1** | **Represent** the Knowledge for the given scenario using appropriate tools techniques and language. | - | 3,4,5 | - |
| **CO-2** | **Identify** data preprocessing requirement of a given data set for the learning algorithms. | - | 3,4,5 | - |
| **CO-3** | **Demonstrate** of the strengths and weaknesses of regression and classification approaches in machine learning. | - | 3,4,5 | - |
| **CO-4** | **Demonstrate** unsupervised algorithms for clustering requirement on a data set from the real world using python. | - | 3,4,5 | - |
| **CO-5** | **Represent** the Knowledge for the given scenario using appropriate tools techniques and language. | - | 3,4,5 | - |

| POs/PSOs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mapping Level | - | - | 2.0 | 2.0 | 2.0 | - | - | - | - | - | - | - | - | - | - | - |

**Pre-requisites:** Knowledge of

1. Logic
2. Discrete Mathematics
3. Programming Fundamentals

## Course Contents

This course is in line with the theory course Artificial Intelligence & Machine Learning (18UCSC700). There will be one problem with the **Knowledge Representation** and four problems on **Machine Learning** (Linear Regression, Multilinear regression, Polynomial regression, Decision Tree, K-means clustering). The problems to be composed by the faculty are announced to the students. The student will analyze the problem, justify the requirement of AI Approach for the solution, choose the platform or technology for implementations and demonstrate all the steps involved like pre-processing the dataset, importing the dataset, Spitting the dataset into the training set and test set, training the model on the training dataset, predicting the test set results, Visualising the Training set results, Visualising the test set results, etc where ever applicable. The students will submit implementation, conduction and observation write up for each problem. An internal examination and 5 problems work will be used to grade the student's performance in this course.

## Associated Lab Works (Sample)

1. Represent facts and relationships of any famous epic of your choice using first order logic, implement and demonstrate some queries.
2. Build a decision tree for the case of SDMCET students' performance based on the IA-1, IA-2, IA-3, CTA, Attendance, SEE marks (optional) and classifying them into one of the Grade S, A, B, C, D, E & F. Study of precision of classification by including the 10th, 12th and CET/COMED-K into consideration.
3. Given the features of an email like , Sender's email ID, Number of typos in the email, Occurrence of words like "offer", "prize", "free Gift", classify the email as Spam or not. Use the feature vector to train a Logistic classifier which emits a score in the range 0 to 1. If the score is more than 0.5, we label the email as spam. Otherwise, we don't label it as spam.
   ( https://magoosh.com/).
4. Linear or polynomial regression to predict the salary of a person given the designation, no of years of experience, location of work, previous financial years profit etc.
5. A Hospital Care chain wants to open a series of Emergency-Care wards within a region. We assume that the hospital knows the location of all the maximum accident-prone areas in the region. They have to decide the number of the

Emergency Units to be opened and the location of these Emergency Units, so that all the accident-prone areas are covered in the vicinity of these Emergency Units. The challenge is to decide the location of these Emergency Units so that the whole region is covered. Here is when K-means Clustering comes to rescue! (https://www.edureka.co/blog/k-means-clustering/)

**18UCSL704 Internship 2 Credits**

**Contact Hours: 4 weeks**

**Course Learning Objectives (CLOs):** Internship provides an opportunity to get industry exposure to real time scenarios that include professional skill development programs and adhere to the professional standards.

**Course Outcomes (COs):**

| **Description of the Course Outcome:** At the end of the course the student will be able to: | | **Mapping to POs(1-12) / PSOs (13-16)** | | |
|---|---|---|---|---|
| | | **Substantial Level (3)** | **Moderate Level (2)** | **Slight Level (1)** |
| **CO-1** | **Explore** the domain knowledge | 1, 8, 2,12 | - | - |
| **CO-2** | **Apply** the knowledge and skills in the professional career. | 3,5, 8, 13,12 | 11, 16 | 6, 7 |
| **CO-3** | **Prepare** a technical report | 4,5, 8, 14,12 | 16 | - |
| **CO-4** | **Demonstrate** the knowledge gained through presentation. | 5, 8, 15,12 | - | - |

| **POs/PSOs** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mapping Level** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 1.0 | 1.0 | 3.0 | 3.0 | 3.0 | 2.0 | 3.0 | 3.0 | 3.0 | 3.0 | 2.0 |

**Prerequisites:** Knowledge of both theory and practical courses learnt in all the previos semesters and relevant value-added information.

## ELECTIVES

**18UCSE705 Computer Graphics (3-0-0) 3**

**Contact Hours: 39**

**Course Learning Objectives (CLOs):** This course introduces fundamental principles of computer graphics, its architecture and how transformations of objects are carried out. It facilitates students to identify good design principles to solve challenges involved in simulating real world objects/conditions. It also provides the students to learn and apply the aspects of interaction with computer and exposes them to open-source tools like OpenGL.

**Course Outcomes (COs):**

| **Description of the Course Outcome:** At the end of the course the student will be able to: | | **Mapping to POs(1-12) / PSOs(13-16)** | | |
|---|---|---|---|---|
| | | **Substantial Level (3)** | **Moderate Level (2)** | **Slight Level (1)** |
| **CO-1** | **Explain** the principles of Computer Graphics Architecture used in industry relevant tool like OpenGL. | - | 13,14 | 1,2,12 |
| **CO-2** | **Explain** the design objectives of APIs used in OpenGL. | - | 14,12 | 1,5 |
| **CO-3** | **Apply** input interaction techniquesused in graphics environment. | 14 | 2 | - |
| **CO-4** | **Apply** affine transformations to solve problems relating to object transformations. | 13 | 14 | 1 |
| **CO-5** | **Discriminate** the views of objects in parallel and perspective projections under various lighting conditions. | - | 13 | 14 |
| **CO-6** | **Formulate** mathematical strategies for scan conversion algorithms to realize basic primitives, and **represent** curve and surfaces. | 13,14 | - | 1,12 |

| **POs/PSOs** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mapping Level** | 1.0 | 1.5 | - | - | 1.0 | - | - | - | - | - | - | 1.3 | 2.5 | 2.1 | - | - |

**Pre-requisites:** Knowledge of

- Basic Engineering Graphics
- Linear Algebra (Scalars, Vectors, Matrices)
- Algorithms and C programming.

**Contents:**

**Unit-I**

**Introduction :** Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging systems; The synthetic camera model; The programmer's

interface; Graphics architectures; Programmable pipelines; Performance characteristics. Graphics Programming: The Sierpinski gasket; Programming two dimensional applications

**Input and Interaction:** Interaction; Input devices; Clients and servers; Display lists; Display lists and modeling; Programming event-driven input; Menus; Picking; A simple CAD program; Building interactive models; Animating interactive programs; Design of interactive programs; Logic operations. **9 Hrs**

**Unit-II**

**Geometric Objects and Transformations:** Scalars, points, and vectors; Coordinate systems and frames; Modeling a colored cube; Affine transformations; Rotation, translation and scaling; Transformations in homogeneous coordinates; Concatenation of transformations; Interfaces to three-dimensional applications. **9 Hrs**

**Unit-III**

**Viewing and Lighting :** Classical and computer viewing; Viewing with a computer; Positioning of the camera; Simple projections; Projections in OpenGL, Hidden surface removal; Parallel-projection matrices; Perspective-projection matrices.

**OpenGL:** Introduction to OpenGL; Programming two-dimensional Application; The OpenGL API; Primitives and Attributes; Color; Control Functions. **7 Hrs**

**Unit-IV**

**Basic Raster Graphics Algorithms for drawing 2D primitives :** Scan converting lines, circles, Filling Rectangles, Polygons; Clipping in a raster world; Clipping lines, polygons; Anti-aliasing **7 Hrs**

**Unit-V**

**Lighting and Shading:** Light and matter; Light sources; The Phong lighting model.

**Representing Curves and Surfaces:** Parametric Cubic Curves – Hermite Curves, Bézier Curves. **7 Hrs**

**Conduction of Practical Sessions:** Practical Sessions to be held with the focus of learning Open Source Tools like OpenGL and its API features. For the successful completion of the course, students are expected to undertake project to explore advanced features of Open Source Tools like OpenGL.

**Reference Books:**


1) Edward Angel, “Interactive Computer Graphics A Top-Down Approach with OpenGL”, 5th Edition, Addison-Wesley, 2008
2) James D Foley, Andries Van Dam, Steven K Feiner & John F Hughes, “Computer Graphics Principles and Practice”, 2nd Edition, Addison-Wesley, 1997.
3) Edward Angel & Dave Shreiner, “Interactive Computer Graphics A Top-Down Approach with Shader-Based OpenGL”, 6th Edition, Addison-Wesley, 2012

**4)** F.S. Hill, Jr., "Computer Graphics Using OpenGL", 2nd Edition, Pearson Education, 2005
**5)** Donald Hearn and Pauline Baker, "Computer Graphics- OpenGL Version", 2nd Edition, Pearson Education, 2003

**18UCSE711 Internet of Things (2-0-2) 3**

**Contact Hours: 39 (26T + 13L)**

**Course Learning Objectives (CLOs):** This course provides the basic understanding of IoT technology, communication protocols, sensor networks and its applications. It focuses on setting up IoT ecosystem to implement use cases by applying the key concepts of IoT.

**Course Outcomes (COs):**

| **Description of the Course Outcome:** At the end of the course the student will be able to: | | **Mapping to POs(1-12)/ PSOs (13-16)** | | |
|---|---|---|---|---|
| | | **Substantial Level (3)** | **Moderate Level (2)** | **Slight Level (1)** |
| **CO-1** | **Explain** the working of IoT and its enabling technologies. | - | 5 | 1, 12 |
| **CO-2** | **Explain** the use cases of IoT andthe useof sensors & actuators in IoT ecosystem. | - | 5 | 1, 12 |
| **CO-3** | **Compare** and **contrast** IoT & M2M and **explain** the generic design methodology for IoT system. | - | 5, 13 | 1, 12 |
| **CO-4** | **Develop** IoT applications using Arduino by making use of sensors and modules. | 13 | 14 | 1, 5, 9, 15 |

| | | | | |
|---|---|---|---|---|
| **CO-5** | **Develop** IoT applications using Raspberry Pi microcontroller by making use of sensors and modules. | 13 | 14 | 1, 5, 9, 15 |
| | | | | |

| POs/PSOs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mapping Level | 1.0 | - | - | - | 1.6 | - | - | - | 1.0 | - | - | 1.0 | 2.7 | 2.0 | 1.0 | - |

**Pre-requisites:** Knowledge of Programming and Basics of Computer Networking

**Contents:**

**Unit-I**

**Introduction to Internet of Things (IoT):** Introduction, Physical and Logical Design of IoT, IoT Enabling Technologies, IoT levels and Deployment templates **7 Hrs**

**Unit-II**

**Domain Specific IoTs:** Introduction, Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health &Lifestyle

**IoT Sensors and Actuators:** Introduction, IoT sensors, RFID, Video Tracking, IoT Actuators **8 Hrs**

**Unit-III**

**IoT and M2M:** Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT

**IoT Platforms Design Methodology:** Introduction, IoT Design Methodology, Case Study on IoT System for Weather Monitoring **7 Hrs**

**Unit-IV**

**Arduino Programming:**Features of Arduino, Arduino UNO, Arduino IDE, Arduino sketch structure, Arduino function libraries, Blinking LED example; Operators, control statements, loops, arrays, string, interrupts, Traffic Control System example

**Integration of Sensors, Actuators and modules with Arduino:** Sensor Types, Sensor Interface with Arduino, Interfacing DHT, LM35, LDR, Accelerometer and HC-SR04 sensors with Arduino; Actuators, Types of Motor Actuators, Servo motor, Servo library on Arduino; HC05 Bluetooth module, Features, Interfacing HC05 with Arduino, Controlling LED using Bluetooth; ESP8266 wifi module, Features, Send LM35 sensor data to cloud using wifi module **2L + 7P Hrs**

**Unit-V**

**Raspberry Pi:** Introduction, Specifications, Basic Architecture, Pin configuration, Blinking LED example; Capture image using Raspberry Pi

**Implementation of IoT with Raspberry Pi:** Temperature dependent auto cooling system; interfacing DHT, LM35, LDR, Accelerometer and HC-SR04 sensors with Raspberry Pi; Send LM35 sensor data to cloud using wifi module. **2L + 6P Hrs**

**Conduction of Practical Sessions:**

Practical sessions shall include experiments on the following:

1) Use of Arduino board and coding to blink built-in as well as external LEDs
2) Interfacing temperature, humidity, soil moisture, light intensity, accelerometer, ultrasonic and obstacle detection sensors with Arduino and displaying the results
3) Connecting modules like Bluetooth and Wi-Fi to Arduino and sending the sensed data to cloud for storage and analytics.
4) Use of Raspberry Pi as a surveillance system

**Reference Books:**


**1)** Arshdeep Bahga, Vijay Madisetti ,"Internet of Things – A Hands-on Approach", Universities Press, 2015

**2)** Ammar Rayes, Samer Salam, "Internet of Things From Hype to Reality – The Road to Digitalization", Second Edition, , Springer Nature Switzerland AG 2017, 2019


**Additional References:**


**3)** NPTEL course on "Introduction to internet of things" by Prof. Sudip Misra


## VIII Semester

| 18UCSE808 | Data Science | (3-0-0) 3 |
|---|---|---|

**Contact Hours: 39**

**Course Learning Objectives (CLOs):** This course is a 3 credit undergraduate course focusing on the data and types, data preprocessing. The details of R language are discussed to enable the students to perform data analytics. It also discusses the supervised and unsupervised learning.

**Course Outcomes (COs):**

| **Description of the Course Outcome:** At the end of the course the student will be able to: | **Mapping to POs(1-12)/ PSOs (13-16)** | | |
|---|---|---|---|
| | **Substantial Level (3)** | **Moderate Level (2)** | **Slight Level (1)** |

| | | | | |
|---|---|---|---|---|
| **CO-1** | **Explain** the flow process for processing data science problems and the data types. | - | 1, 2 | 13 |
| **CO-2** | **Apply** the preprocessing methods to the raw data to make it available for analysis. | 1, 2 | - | - |
| **CO-3** | **Use** the R language to perform the data visualization and the analysis using fundamental statistical technques. | 3 | - | 12 |
| **CO-4** | Explain the machine learning technques. | - | 1, 2 | 13 |
| **CO-5** | Explain the unsupervised learning technques. | - | 1, 2 | 13 |

| **POs/PSOs** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mapping Level** | 2.3 | 2.3 | 3.0 | - | - | - | - | - | - | - | - | 1.0 | 1.0 | - | - | - |

**Pre-requisites:** Knowledge of Statistics

**Contents:**

**Unit-I**

**Introduction:** Evolution, Roles, Stages in Data Science Project, Applications, Data Security and Privacy Issues

**Data:** Data types - Structured and Unstructured, Challenges with Unstructured data, Social media data, Multi modal data, Data Storage and Presentation **7 Hrs**

**Unit-II**

**Data Preprocessing:** Cleaning, Integration, Transformation, Reduction, Discretization.

**Techniques:** Correlation, Regression. Exploratory Analysis. **7 Hrs**

**Unit-III**

**R Language**: Basics, Control structures, Functions, Impoting Data.

**Graphics and Data Visualization:** Installing gglot2, Loading the data, Plotting the Data.

**Statistics and Machine Learning:** Basic Statistics, Regression, Clustering **9 Hrs**

**Unit-IV**

**Machine Learning:** Introduction, Regression, Classification, Gradient Descent. **8 Hrs**

**Unit-V**

**Unsupervised Learning:** Introduction, Agglomerative Clustering, Reinforcement Learning **8 Hrs**

**Reference Books:**


1) Chirag Shah, “A Hands on Introduction to Data Science”, Cambridge University Press, 2020
2) Laura Igual and Santi Segui, “Introduction to Data Science”, Springer International Publications, 2017
3) Richord Cotton “Learning R”, O’Reilly Publications, 2013.


## 18UCSE809 Blockchain Technology (3-0-0) 3

**Contact Hours: 39**

**Course Learning Objectives (CLOs):** This course focuses on understanding emerging abstract models for Blockchain Technology and familiarizes the functional/operational aspects of the crypto currency ecosystem. Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.

**Course Outcomes (COs):**

| **Description of the Course Outcome:** At the end of the course the student will be able to: | | **Mapping to POs(1-12)/ PSOs (13-16)** | | |
|---|---|---|---|---|
| | | **Substantial Level (3)** | **Moderate Level (2)** | **Slight Level (1)** |
| **CO-1** | **Demonstrate** the basics of Block chain concepts using modern tools/technologies. | - | 3, 4, 5 | 1,13 |
| **CO-2** | **Analyze** the role of block chain applications in different domains including cyber security. | - | 3, 5 | - |
| **CO-3** | **Evaluate** the usage of Block chain implementation/features for the given scenario. | - | 1, 3, 4 | 14 |
| **CO-4** | **Exemplify** the usage of bitcoins and its impact on the economy. | 3 | - | - |
| **CO-5** | **Analyze** the application of specific block chain architecture for a given problem. | 3 | 2 | 6 |

| **POs/PSOs** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mapping Level** | 1.0 | 2.4 | 1 | 2 | 1 | - | - | - | - | - | - | - | 1.0 | 1.0 | - | - |

**Pre-requisites:** Knowledge of any Object Oriented Programming language and Data Structures.

**Contents:**

**Unit-I**

**Introduction:** Introduction to Blockchain, How Blockchain works, Blockchain vs. Bitcoin, Practical applications, public and private key basics, pros and cons of Blockchain, Myths about Bitcoin. **7 Hrs**

**Unit-II**

**Blockchain Architecture and Types**: Architecture, versions, variants, use cases, Life use cases of Blockchain, Blockchain vs. shared Database, Introduction to crypto currencies, Types, Applications. **8 Hrs**

**Unit-III**

**Blockchain Data Structures and Working:** Concept of Double Spending, Hashing, Mining, Proof of work. Introduction to Merkel tree, Privacy, payment verification, Resolving Conflicts, Creation of Blocks. **8 Hrs**

**Unit-IV**

**Bitcoins:** Introduction to Bitcoin, key concepts of Bitcoin, Merits and Demerits Fork and Segwits, Sending and Receiving bitcoins, choosing bitcoin wallet, Converting Bitcoins to Fiat Currency. **8 Hrs**

**Unit-V**

**Ethereum:** Introduction to Ethereum, Advantages and Disadvantages, Ethereum vs. Bitcoin, Introduction to Smart contracts, usage, application, working principle, Law and Regulations. Case Study. **8 Hrs**

**Reference Books:**


**1)** Arshdeep Bikramaditya Signal, Gautam Dhameja, Priyanshu Sekhar Panda "Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions" Apress Publications, 2018.

**2)** Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands-On Approach", VPT Publications, 2017.

**3)** Swan Melanie, "Blockchain: Blueprint for New Economy", O'Reilly Publications, 2018.

**4)** Aravind Narayan, Joseph Bonneau, Edward Felten at al "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction" Princeton University Press, 2016

**5)** Daniel Drescher, “Blockchain Basics: A Non-Technical Introduction in 25 Steps”, Apress Publications, 2017.

**Additional References:**

**1)** https://www.guru99.com/blockchain-tutorial.html
**2)** https://developer.ibm.com/technologies/blockchain/gettingstarted/

# PG Courses

| 18PCSEE125 | Research Methodology and IP | (3-0-2) 4 Credits |
|---|---|---|

Contact Hours: 39T+26L

Course Learning Objectives

- To facilitate and enable students to learn the art of developing the most appropriate methodology for research studies.
- To make the students familiar with the art of using different research methods and techniques.
- To make students to familiar with IPR

Course Outcomes (POs):

| Description of the Course Outcome: At the end of the course the student will be able to: | | Mapping to POs(1,11) | | |
|---|---|---|---|---|
| | | Substantial Level (3) | Moderate Level (2) | Slight Level (1) |
| CO 1 | Formulate the research problems. | - | 1 | - |
| CO 2 | Comprehend and explain literature survey of chosen domain | 3 | - | - |
| CO 3 | Write the technical project report/proposals | 2 | - | - |
| CO 4 | Explain Patenting, Copyright, Technology transfer and innovations. | - | 4 | - |
| CO 5 | Practice research ethics for lifelong learning | - | 5,6 | - |

Mapping Level:

| POs | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 |
|---|---|---|---|---|---|---|
| Mapping Level | 2 | 3 | 3 | 2 | 2 | 2 |

Pre-requisites: Knowledge of Analytical and Logical thinking, and English writing skills.

Course Contents:

| | | |
|---|---|---|
| 1 | Research Methodology: An Introduction: Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India,<br>Defining the Research Problem: What is a Research Problem?, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration<br>Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs,<br>Sampling Design: Census and Sample Survey, Implications of a Sample Design, Steps in Sampling Design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Different Types of Sample Designs, How to Select a Random Sample?, Random Sample from an Infinite Universe, Complex Random Sampling Designs Methods of Data Collection : Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Schedules, Difference between Questionnaires and Schedules, Some Other Methods of Data Collection, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method | 16 Hrs |
| 2 | Quantitative Methods: Statistics: Probability & Sampling distribution; Estimation, Hypothesis testing & application; Chi-square Test, The research proposal in quantitative and qualitative research, Contents of a research proposal, Preamble/introduction, The problem, Objectives of the study, Hypotheses to be tested, Study design, The setting, Measurement procedures, Ethical issues. Sampling, Analysis of data, Structure of the report, Problems and limitations Case Study | 15 Hrs |
| 3 | Introduction to IPR : Copyright and Related Rights, Industrial Property ;Patents, Industrial Designs, Trade Marks, Geographical Indications, Layout Designs/Topographies, Integrated Circuits, Trade Secrets, Protection of New Plant Varieties, USPTO, Justia, ACM in the context of IPR | 4 Hrs |

| | | |
|---|---|---|
| 4 | Computer Applications: Latex and Word Processor tools for Thesis writing & Scientific editing tools. Indexing, Citation and References in IEEE format. | 4 Hrs |

List of Assignments:

1. Identify a research problem.
2. Conduct a thorough Literature review.
3. Identify technique for data collection and interpretation.
4. Writing a research proposal and Indexing, Citation and References in IEEE format.
5. Identifying typical issues in IPR real time using USPTO, Justia, ACM references
6. Use Latex and other tools for report writing.

Reference Book


1. Research Methodology Methods and Techniques by C R Kothari, Second Revised Edition, 2004 New Age International (P) Limited, Publishers
2. Research Methodology: A Step by Step Guide for beginners", Ranjit Kumar, 3nd Edition. 2011 SAGE Publications India Pvt. Ltd.
3. Intellectual Property Rights-Law And Practice - The Institute Of Company Secretaries Of India


Website:

**https://www.justia.com**
https://www.uspto.gov/
https://www.acm.org

| 18PCSEE226 | Data Science | (3-0-2) 4 |
|---|---|---|

**Course Learning Objectives**: This course is at undergraduate level for 52 contact hours with focus on following learning objectives:

- To understand concepts underlying Data Science.
- To understand big data and its applications to various fields.
- To Manage Big data without SQL.
- To Work with R tool for statistical analysis.
- To Analyse the social networks.

**Course Outcomes**: At the end of this course, students will be able to demonstrate the following course outcomes.

| CO # | Description of Course Outcomes | Substantial | Moderate | Low |
|---|---|---|---|---|
| CO 1 | Differentiate between conventional SQL query language and NoSQL basic concepts | 1 | | |
| CO 2 | Describe big data and its presence in various fields. | 1 | | |
| CO 3 | Perform map-reduce analytics using Hadoop. | 3 | | |
| CO 4 | Use R tool to carry out basic statistical modeling and analysis. | 3,5 | | |
| CO 5 | Knowledge of social network analysis and its applications. | 1 | | |

| PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mapping Level | 3 | | 3 | | 3 | | | | | | |

**Pre-Requisites:** Knowledge of

- RDBMS,
- Statistics, and
- Graph Theory

**Course Contents:**

1. **INTRODUCTION TO DATA SCIENCE:** 8 Hrs

   Data science process – roles, stages in data science project – working with data from files – working with relational databases – exploring data – managing data – cleaning and sampling for modeling and validation, Introduction to NoSQL.

2. **BIG DATA AND ANALYTICS:** Distributed file system–Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce. 8 Hrs

3. **HADOOP AND HADOOP ARCHITECTURE:** Big Data – Apache Hadoop & Hadoop EcoSystem, Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce. 8 Hrs

4. **MODELLING METHODS:** Choosing and evaluating models, Mapping problems to machine learning, Evaluating clustering models, Validating models, Cluster analysis – K-means algorithm, Naïve Bayes, Memorization Methods – Linear and logistic regression. 10 Hrs

5. **INTRODUCTION TO R:** Reading and getting data into R, Ordered and unordered factors, Arrays and matrices, Lists and data frames,Reading data from files, Probability distributions, Statistical models in R, Manipulating objects,Data distribution. 8 Hrs

6. **MINING SOCIAL-NETWORK GRAPHS:** Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighborhood properties in graphs. 10 Hrs

**Reference Books:**


1. Tom White, " Hadoop: The definitive Guide",3rd edition,O'Reilley,2012
2. Eric Sammer,"Hadoop operations", O'Reilley,2012
3. Vignesh Prajapati,"Big data analytics with R & Hadoop",SPD 2013
4. Pang-Ning Tan, Michael Steinbach, Vipin Kumar "Introduction to Data Mining" Addison Wesley,2005
5. Jure Leskovee,Anand Rajaraman, Jeff Ullaman" Mining of Massive Datasets",2nd edition Cambridge University,2015


| 18PCSEE227 | Machine Learning | (3-0-2) 4 Credits |
|---|---|---|

**Contact Hours: 39T+26L**

## Course Learning Objectives

This course focuses on the basic principles of machine learning and design machine learning system with proper exposure to appropriate programming language, mathematical modelling, and Architectural strategy of ML, knowledge representation and Industry relevant tools / Library for developing intelligent systems.

## Course Outcomes:

| Description of the Course Outcome: At the end of the course the student will be able to: | | Mapping to POs/ PSOs | | |
|---|---|---|---|---|
| | | Substantial Level (3) | Moderate Level (2) | Low Level (1) |
| CO 1 | **Design** an appropriate knowledge model for a given problem scenario using concept learning | 1,2,3,4 | - | - |
| CO 2 | **Design** an appropriate knowledge model for a given problem scenario using neural networks | 1,2,3,4 | - | - |
| CO 3 | **Design** an appropriate knowledge model for a given problem scenario using Bayesian technique | 1,2,3,4 | - | - |
| CO 4 | **Write** a program in any appropriate language for a | 1,2,3,4 | - | - |
| CO 5 | **Evaluate** the effectiveness of a given learning | 1,2,3,4 | - | - |
| CO 6 | Explore the standard dataset available in public | 1,2,3,4 | - | - |
| CO 7 | Conduct experiments and develop a proper dataset capturing real time features in a given domain | 1,2,3,4 | - | - |

**Mapping Level**

| POs | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 |
|---|---|---|---|---|---|---|
| **Mapping Level** | 3 | 3 | 3 | 3 | - | - |

**Pre-requisites:** The students meet the following prerequisites:

- Basic programming skills
- Algorithm design
- Basics of probability & statistics

**Course Contents:**

1 **Introduction, Concept Learning And Decision Trees:** Learning Problems–Designing Learning systems, Perspectives and Issues–Concept Learning–Version Spaces and Candidate Elimination Algorithm–Inductive bias–Decision Tree learning–Representation–Algorithm–Heuristic Space Search. **09 Hrs**

| | | |
|---|---|---|
| 2 | **Neural Networks And Genetic Algorithms:** Neural Network Representation– Problems–Perceptrons–Multilayer Networks and Back Propagation Algorithms– Advanced Topics–Genetic Algorithms–Hypothesis Space Search–Genetic Programming – Models of Evolution and Learning. | **10 Hrs** |
| 3 | **Bayesian And Computational Learning:** Bayes Theorem–Concept Learning–Maximum Likelihood–Minimum Description Length Principle–Bayes Optimal Classifier–Gibbs Algorithm–Naïve Bayes Classifier–Bayesian Belief Network–EM Algorithm–Probably Learning–Sample Complexity for Finite and Infinite Hypothesis Spaces–Mistake Bound Model. | **10 Hrs** |
| 4 | **Instant Based Learning And Learning Set Of Rules:** K- Nearest Neighbor Learning–Locally Weighted Regression–Radial Basis Functions–Case-Based Reasoning–Sequential Covering Algorithms–Learning Rule Sets–Learning First Order Rules–Learning Sets of First Order Rules–Induction as Inverted Deduction–Inverting Resolution. | **10 Hrs** |

**Additional contents beyond the syllabi:**

- Exposure to research avenues in the field of Machine Learning.
- Seminars on the research work done using Machine Learning algorithms.
- Certification course

**LABORATORY WORK**

(The following tasks can be implemented in a language of your choice or any tools available)

1. Implement the **CANDIDATE–ELIMINATION** algorithm. Show how it is used to learn from training examples and hypothesize new instances in Version Space.
2. Implement the **FIND–S** algorithm. Show how it can be used to classify new instances of target concepts. Run the experiments to deduce instances and hypothesis consistently.
3. Implement the **ID3** algorithm for learning Boolean–valued functions for classifying the training examples by searching through the space of a Decision Tree.
4. Implement the **Genetic algorithm**.
5. Design and implement **Naïve Bayes** Algorithm for learning and classifying **TEXT DOCUMENTS**.

**Reference Books:**

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (INDIAN EDITION), 2013.

2. EthemAlpaydin, “Introduction to Machine Learning”, 2nd Edition, PHI Learning Pvt. Ltd., 2013.
3. T. Hastie, R. Tibshirani, J. H. Friedman, “The Elements of Statistical Learning”, Springer; 1st edition, 2001.
4. Pattern Recognition and Machine Learning by Christopher M Bishop, Springer, 2016

| 18PCSEE231 | Internet of Things | (3-0-2) 4 |
|---|---|---|

**Contact Hours: 39T+26L**

**Course Learning Objectives:**

This course provides basic insights on architecture, communication protocols, sensor networks and applications of IoT. It also focuses on implementation of various use cases of IoT with Arduino and Raspberry Pi.

**Course Outcomes:**

| Description of the Course Outcome: At the end of the course the student will be able to: | | Mapping to POs/ PSOs | | |
|---|---|---|---|---|
| | | Substantial Level (3) | Moderate Level (2) | Low Level (1) |
| CO 1 | Explain the need for IoT and its application | - | 3 | 6 |
| CO 2 | Explain various networking and | - | 3 | 1,6 |
| CO 3 | Explain the architecture and applications | 3 | - | 1,6 |
| CO 4 | Explain the concepts of M2M | - | 3 | 6 |
| CO 5 | Demonstrate use cases of IoT using | - | 3,4 | 6 |

**Mapping Level:**

| POs | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 |
|---|---|---|---|---|---|---|
| **Mapping Level** | 1.0 | - | 2.2 | 2 | - | 1.0 |

**Pre-requisites:** Computer Networks basics and knowledge of microcontrollers and microprocessors.

**Course Contents:**

| | | |
|---|---|---|
| 1. | **Introduction to IoT:** What is IoT; IoT overview; Applications of IoT; Sensing- what is a sensor and transducer, sensor types; Actuation- what are actuators, actuator types | **06 Hrs** |
| 2. | **IoT Networking:** Basics of IoT networking; components of IoT; service oriented architecture of IoT | **02 Hrs** |
| 3. | **IoT Protocols:** IoT Protocols-MQTT, SMQTT, CoAP, XMPP, AMQP; Communication Protocols- IEEE 802.15.4, ZigBee, 6LoWPAN, HART, Bluetooth, Zwave, ISA 100.11 A | **06 Hrs** |
| 4. | **WSNs and UAV Networks :** WSNs- what is wireless sensor network, concepts and challenges, node behavior; Applications of WSNs- Target/Object Tracking, Agriculture; UAV Networks- features, constraints, advantages, topologies | **06 Hrs** |
| 5. | **M2M Communication and Interoperability in IoT:** M2M communication-concepts, features, applications, node types, M2M area management; Interoperability in IoT- challenges, types of interoperability (ex: syntactic and device interoperability) | **03 Hrs** |
| 6. | **Arduino Microcontroller and Sensor Integration:** Arduino Microcontroller-what is Arduino, arduino programming, features, arduino boards, arduino IDE, blinking LED; Sensor Integration- integration of various sensors with arduino | **05 Hrs** |
| 7. | **Implementation of IoT with Raspberry Pi:** Raspberry Pi- architecture, components, blinking LED, image processing with Raspberry Pi; Interfacing various sensors with arduino | **05 Hrs** |
| 8. | **IoT with Cloud and Data Processing:** Sending collected sensor data to cloud using recent cloud services like ThingSpeak; IBM bluemix and processing the data using IBM Watson APIs | **06 Hrs** |

**Reference Books:**


1. Pethuru Raj, Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms and Use Cases”, CRC Press, 2017
2. ArshdeepBahga, Vijay Madisetti,“Internet of Things – A Hands-on Approach”, Universities Press, 2015
3. Research Papers.

**Laboratory Assignments:**

1. Programs to blink LED (internal/external) using Arduino / Raspberry Pi. CO-6,7
2. Programs to interface sensors (LM35, DHT, LDR, Ultrasonic) using Arduino / Raspberry Pi. CO-1, 6,7
3. Programs interface Bluetooth/ Wi-fi modules to Arduino / Raspberry Pi and send sensor data to cloud using cloud APIs. CO-3,6,7
4. Programs to explore protocols like MQTT, CoAP, and ZigBee using Arduino / Raspberry Pi. CO-3,6,7
5. Programs to send sensor data to cloud and perform data analytics using platforms like ThingSpeak / IBM Watson APIs. CO-6,7,8
6. Programs to realize IoT case studies like Home Automation, Smart Agriculture, Smart Cities, etc. CO-6,7

| 18PCSEE329 | Natural Language Processing and Test Mining | (3-0-2) 4 |
|---|---|---|

**Course Learning Objectives**: This course will enable student to

- Process the raw text by applying NLP techniques.
- Categorize and tag the information.
- To apply machine learning algorithms for text analysis.

**Course Outcomes**: At the end of this course, students will be able to demonstrate the following course outcomes.

| CO | Description of Course Outcomes | Substanti | Mod | Lo |
|---|---|---|---|---|
| CO 1 | Understand approaches to syntax and semantics in NLP. | - | 9 | - |
| CO 2 | Understand approaches to discourse, generation and summarization within NLP | 3 | - | - |
| CO 3 | Understand machine learning techniques used in NLP, including hidden Markov models and grammars | - | 2 | 5 |

| | | | | |
|---|---|---|---|---|
| CO 4 | To understand the basic issues and types of text mining. | 3 | 4 | - |
| CO 5 | Understand existing classification/clustering algorithms in terms of features extraction. | 3 | 2,5 | 4 |

| PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mapping Level | - | 2 | 3 | 1.5 | 1.5 | - | - | - | 2 | - | - |

**Pre-Requisites:** Basic Probability and Statistics.
Knowledge of Machine learning.

**Course Content**

1. **Introduction:** Basics of Statistical Natural Language Processing, Mathematical Foundations - Elementary Probability Theory, Essential Information Theory, Parts of Speech and Morphology, Phrase Structure, Looking at Text & Marked-up Data. — 10 Hrs

2. **Words**: Collocations, Statistical Inference: n -gram Models over Sparse Data-Bins: Forming Equivalence Classes, Statistical Estimators, Combining Estimators, Word Sense Disambiguation- Methodological Preliminaries, Supervised & Unsupervised Disambiguation, Dictionary-Based Disambiguation. — 10 Hrs

3. **Grammar:** Markov Models, Hidden Markov Models, HMMs: Implementation, Properties, and Variants Part-of-Speech Tagging-The Information Sources in Tagging, Markov Model Taggers, Hidden Markov Model Taggers, Transformation-Based Learning of Tags, Other Methods, Other Languages, Tagging Accuracy and Uses of Taggers — 12 Hrs

4. **Introduction to Text Mining:** Overview of text mining, General Architecture, Core Operations, Preprocessing, Document classification, Information extraction, Textual information to numerical vectors- Document standardization, tokenization, lemmatization, vector generation ,evaluation performance and recent trends like sentiment analysis — 08 Hrs

5. **Text Categorization:** Feature Selection - Decision Tree Classifiers, Rule-based Classifiers, Probabilistic and Naive Bayes Classifiers, Linear Classifiers. Classification of Linked and Web Data, Word and Phrase-based — 12 Hrs

Clustering, Supervised and Unsupervised Clustering, Text Summarization Techniques, Latent Semantic Indexing, Probabilistic Latent Semantic Indexing.

**Reference Books:**


1. Foundations of Statistical Natural Language Processing by, Christopher Manning , MIT Press, July 1999.
2. Sholom Weiss, Nitin Indurkhya, Tong Zhang, Fred Damerau "The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data", Springer, paperback 2010.
3. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, Pearson Education India,2nd edition (2013).