# CURRICULUM & SYLLABUS

## For

## B.E(Hons.) Computer Science and Engineering with Specialization in Internet of Things

**(Choice Based Credit System)**

**(With effect from 2018)**

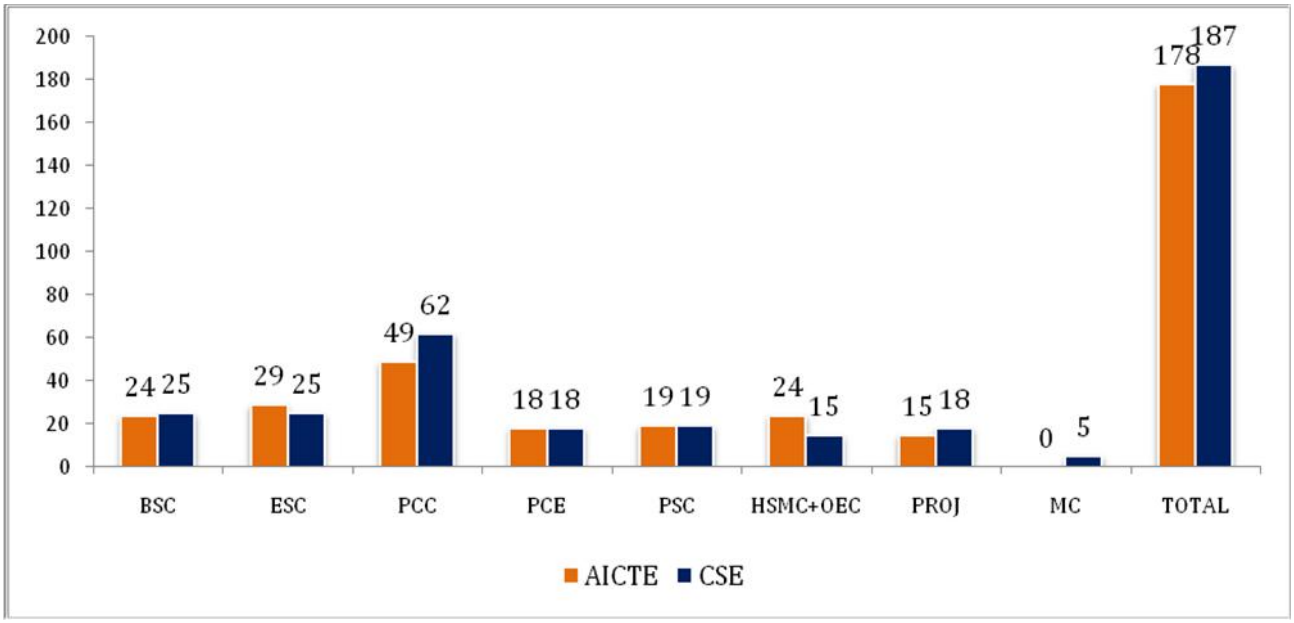

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**Sri Chandrasekharendra Saraswathi ViswaMahavidyalaya**
**SCSVMV**
**(Deemed to be University U/S 3 of UGC Act 1956)**
**Accredited with "A" Grade by NAAC**
**Enathur, Kanchipuram – 631 561**

| PROGRAM OUTCOMES [PO's] | |
|---|---|
| **PO 1** | Apply basic principles and practices of computing grounded in mathematics and science to successfully complete software related projects to meet customer business Objective(s) and/or productively engage in research. |
| **PO 2** | Apply their knowledge and skills to succeed in a computer science career and/or obtain an advanced degree. |
| **PO 3** | Demonstrate an ability to use techniques, skills, and modern computing tools to implement and organize computing works under given constraints. |
| **PO 4** | Demonstrate problem solving and design skills including the ability to formulate problems and their solutions, think creatively and communicate effectively. |
| **PO 5** | Develop software as per the appropriate software life cycle model. |
| **PO 6** | Organize and maintain the information of an organization. |
| **PO 7** | Exhibit teamwork, communication, and interpersonal skills which enable them to work effectively with interdisciplinary teams. |
| **PO 8** | Provide an excellent education experience through the incorporation of current pedagogical techniques, understanding of contemporary trends in research and technology, and hands-on laboratory experiences that enhance the educational experience. |
| **PO 9** | Demonstrate an ability to engage in life-long learning. |
| **PO 10** | Function ethically and responsibly, and to remain informed and involved as full participants in our profession and our society. |

| DISTRIBUTION OF CREDITS | | | | |
|---|---|---|---|---|
| Sl. No | Course Category | As per AICTE regulation 2018 | Credits | Percentage (%) |
| 1. | Basic Science Courses (BSC) | 24 | **25** | **14.97** |
| 2. | Engineering Science Courses (ESC) | 29 | **25** | **14.97** |
| 3. | Professional Core Courses (PCC) | 49 | **62** | **37.13** |
| 4. | Professional Core Electives Courses (PCE) | 18 | **18** | **10.78** |
| 5. | Professional Specialized Courses (PSC) | 19 | **19** | **11.37** |
| 6. | Humanities and Social Sciences including Management courses (HSMC) + Open Electives Courses (OEC) | 24 | **15** | **8.98** |
| 7. | Project work, seminar and internship in industry or else where(PROJ) | 15 | **18** | **10.78** |
| 8. | Mandatory Courses (MC) | - | **5** | **2.39** |
| **Total** | | **178** | **187** | **100** |

# B.E(Hons.) Computer Science and Engineering with Specialization in Internet of Things



## EACH COURSE IN CATEGORY WISE

| Basic Science Course(BSC) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SL. No | Semester | Course Category | Course Code | Name of the Course | Hours per week | | | Credit |
| | | | | | L | T | P | |
| 1. | 1 | BSC | | Mathematics – I (Calculus and Linear Algebra) | 3 | 1 | 0 | 4 |
| 2. | 1 | BSC | | Chemistry –I | 3 | 0 | 0 | 3 |
| 3. | 1 | BSC | | Chemistry Lab | 0 | 0 | 3 | 2 |
| 4. | 2 | BSC | | Mathematics-II (Probability and Statistics) | 3 | 1 | 0 | 4 |
| 5. | 2 | BSC | | Physics – I (Semi Conductor and Physics) | 3 | 0 | 0 | 3 |
| 6. | 2 | BSC | | Physics Lab | 0 | 0 | 3 | 2 |
| 7. | 3 | BSC | | Mathematics- III (Differential Calculus) | 4 | 1 | 0 | 4 |
| 8. | 7 | BSC | | Computational Biology | 2 | 1 | 0 | 3 |
| **Total Credits** | | | | | | | | **25** |

| Engineering Science Courses(ESC) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SL. No | Semester | Course Category | Course Code | Name of the Course | Hours per week | | | Credit |
| | | | | | L | T | P | |
| 1. | 1 | ESC | | Basic Electrical Engineering | 3 | 0 | 0 | 3 |
| 2. | 1 | ESC | | Engineering Graphics and Design | 1 | 0 | 4 | 3 |
| 3. | 1 | ESC | | Basic Electrical Engineering Lab | 0 | 0 | 3 | 2 |
| 4. | 2 | ESC | | Workshop/Manufacturing Practices | 1 | 0 | 4 | 2 |
| 5. | 3 | ESC | | Digital Electronics | 3 | 1 | 0 | 3 |
| 6. | 3 | ESC | | Digital Electronics Lab | 0 | 0 | 3 | 2 |
| 7. | 4 | ESC | | Microprocessor and Microcontroller | 3 | 0 | 0 | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 8. | 4 | ESC | | Microprocessor and Microcontroller Lab | 0 | 0 | 3 | 2 |
| 9. | 2 | ESC | | Programming for Problem Solving | 3 | 0 | 0 | 3 |
| 10. | 2 | ESC | | Programming for Problem Solving Lab | 0 | 0 | 4 | 2 |
| **Total Credits** | | | | | | | | **25** |

| **Professional Core Courses(PCC)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **SL. No** | **Semester** | **Course Category** | **Course Code** | **Name of the Course** | **Hours per week** | | | **Credit** |
| | | | | | **L** | **T** | **P** | |
| 1. | 3 | PCC | | Data Structures and Algorithms | 3 | 0 | 0 | 3 |
| 2. | 3 | PCC | | Data Structures and Algorithms Lab | 0 | 0 | 4 | 2 |
| 3. | 3 | PCC | | Object Oriented Programming using C++ | 3 | 0 | 0 | 3 |
| 4. | 3 | PCC | | Object Oriented Programming using C++ Lab | 0 | 0 | 4 | 2 |
| 5. | 4 | PCC | | Python Programming Lab | 0 | 0 | 3 | 2 |
| 6. | 4 | PCC | | Discrete Mathematics | 4 | 1 | 0 | 4 |
| 7. | 4 | PCC | | Computer Organization and Architecture | 3 | 0 | 0 | 3 |
| 8. | 4 | PCC | | Computer Architecture Lab | 0 | 0 | 4 | 2 |
| 9. | 4 | PCC | | Design and Analysis of Algorithms | 3 | 0 | 0 | 3 |
| 10. | 4 | PCC | | Design and Analysis of Algorithms Lab | 0 | 0 | 4 | 2 |
| 11. | 4 | PCC | | IT Workshop(Scientific Lab) | 0 | 0 | 3 | 2 |
| 12. | 5 | PCC | | Automata Theory | 4 | 1 | 0 | 4 |
| 13. | 5 | PCC | | Operating Systems | 3 | 0 | 0 | 3 |
| 14. | 5 | PCC | | Operating Systems Lab | 0 | 0 | 4 | 2 |
| 15. | 5 | PCC | | Programming in Java | 3 | 0 | 0 | 3 |
| 16. | 5 | PCC | | Java Programming Lab | 0 | 0 | 4 | 2 |
| 17. | 5 | PCC | | Database Management System | 3 | 0 | 0 | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 18. | 5 | PCC | | Database Management System Lab | 0 | 0 | 4 | 2 |
| 19. | 6 | PCC | | Compiler Design | 3 | 0 | 0 | 3 |
| 20. | 6 | PCC | | Compiler Design Lab | 0 | 0 | 4 | 2 |
| 21. | 6 | PCC | | Computer Networks | 3 | 0 | 0 | 3 |
| 22. | 6 | PCC | | Computer Networks Lab | 0 | 0 | 4 | 2 |
| 23. | 6 | PCC | | Object Oriented Analysis and Design | 3 | 0 | 0 | 3 |
| 24. | 6 | PCC | | Open CV Lab | 0 | 0 | 4 | 2 |
| **Total Credits** | | | | | | | | **62** |

| **Professional Core Elective Course(PCE)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **SL. No** | **Semester** | **Course Category** | **Course Code** | **Name of the Course** | **Hours per week** | | | **Credit** |
| | | | | | **L** | **T** | **P** | |
| 1. | 5 | PCE | | Elective - I | 3 | 0 | 0 | 3 |
| 2. | 6 | PCE | | Elective - II | 3 | 0 | 0 | 3 |
| 3. | 6 | PCE | | Elective - III | 3 | 0 | 0 | 3 |
| 4. | 7 | PCE | | Elective - IV | 3 | 0 | 0 | 3 |
| 5. | 7 | PCE | | Elective - V | 3 | 0 | 0 | 3 |
| 6. | 8 | PCE | | Elective - VI | 3 | 0 | 0 | 3 |
| **Total Credits** | | | | | | | | **18** |

| **Open Elective Courses(OEC)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **SL. No** | **Semester** | **Course Category** | **Course Code** | **Name of the Course** | **Hours per week** | | | **Credit** |
| | | | | | **L** | **T** | **P** | |
| 1. | 7 | OEC | | Open Elective – I | 3 | 0 | 0 | 3 |
| 2. | 8 | OEC | | Open Elective – II | 3 | 0 | 0 | 3 |
| 3. | 8 | OEC | | Open Elective – III | 3 | 0 | 0 | 3 |

| Total Credits | 9 |
|---|---|

| Humanities and Social Science Including Management Courses (HSMC) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SL. No | Semester | Course Category | Course Code | Name of the Course | Hours per week | | | Credit |
| | | | | | L | T | P | |
| 1. | 2 | HSMC | | English | 2 | 0 | 1 | 3 |
| 2. | 4 | HSMC | | Management-I (Principles of Management) | 3 | 0 | 0 | 3 |
| Total Credits | | | | | | | | 9 |

| Mandatory Courses(MC) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SL. No | Semester | Course Category | Course Code | Name of the Course | Hours per week | | | Credit |
| | | | | | L | T | P | |
| 1. | 4 | MC | | Sanskrit and Indian Culture –I | 2 | 0 | 0 | 2 |
| 2. | 2 | MC | | Environmental Science | 2 | 0 | 0 | 2 |
| 3. | 1 | MC | | English Proficiency Certification | 2 | 0 | 0 | 1 |
| Total Credits | | | | | | | | 5 |

| Professional Specialized Courses (PSC) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SL. No | Semester | Course Category | Course Code | Name of the Course | Hours per week | | | Credit |
| | | | | | L | T | P | |
| 1. | 3 | PSC | | Internet of Things: Architecture, Protocols and Applications | 3 | 0 | 0 | 3 |
| 2. | 4 | PSC | | Embedded Systems and Programs using Python Lab | 3 | 0 | 2 | 5 |
| 3. | 5 | PSC | | IOT Security | 3 | 0 | 0 | 3 |
| 4. | 6 | PSC | | Architecting smart IOT Devices | 3 | 0 | 0 | 3 |
| 5. | 7 | PSC | | Fog Computing & Energy Management in IOT Devices | 3 | 0 | 0 | 3 |
| 6. | 7 | PSC | | Web and Mobile Application Programming for IOT & Lab | 0 | 0 | 2 | 2 |
| Total Credits | | | | | | | | 19 |

| PROJECT and Internship(PROJ) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SL. No | Semester | Course Category | Course Code | Name of the Course | Hours per week | | | Credit |
| | | | | | L | T | P | |
| 1. | 6 | PROJ | | Creative and Innovative Project | - | - | - | 3 |
| 2. | 7 | PROJ | | Project work – Phase-I | - | - | - | 3 |
| 3. | 7 | PROJ | | Industrial Internship and Training | - | - | - | 2 |
| 4. | 8 | PROJ | | Project work – Phase-II | - | - | - | 10 |
| **Total Credits** | | | | | | | | **18** |

| Professional Core Elective Course(PCE) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SL. No | Semester | Course Category | Course Code | Name of the Course | Hours per week | | | Credit |
| | | | | | L | T | P | |
| 1. | | PCE | | Advanced Algorithms | 3 | 0 | 0 | 3 |
| 2. | | PCE | | Parallel and Distributed Algorithms | 3 | 0 | 0 | 3 |
| 3. | | PCE | | Quantum Computing | 3 | 0 | 0 | 3 |
| 4. | | PCE | | Information Theory and Coding | 3 | 0 | 0 | 3 |
| 5. | | PCE | | Advanced Computer Architecture | 3 | 0 | 0 | 3 |
| 6. | | PCE | | Software Engineering | 3 | 0 | 0 | 3 |
| 7. | | PCE | | Advanced Operating Systems | 3 | 0 | 0 | 3 |
| 8. | | PCE | | Ad-Hoc and Sensor Networks | 3 | 0 | 0 | 3 |
| 9. | | PCE | | Internet-of-Things | 3 | 0 | 0 | 3 |
| 10. | | PCE | | Artificial Intelligence | 3 | 0 | 0 | 3 |
| 11. | | PCE | | Soft Computing | 3 | 0 | 0 | 3 |
| 12. | | PCE | | Machine Learning | 3 | 0 | 0 | 3 |
| 13. | | PCE | | Data Mining | 3 | 0 | 0 | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 14. | | PCE | | Big Data Analytics | 3 | 0 | 0 | 3 |
| 15. | | PCE | | Pattern Recognition | 3 | 0 | 0 | 3 |
| 16. | | PCE | | Information Retrieval Techniques | 3 | 0 | 0 | 3 |
| 17. | | PCE | | Natural Language Processing | 3 | 0 | 0 | 3 |
| 18. | | PCE | | Image Processing | 3 | 0 | 0 | 3 |
| 19. | | PCE | | Cloud Infrastructure and Services | 3 | 0 | 0 | 3 |
| 20. | | PCE | | Human Computer Interaction | 3 | 0 | 0 | 3 |
| 21. | | PCE | | Robotic Process Automation (RPA) | 3 | 0 | 0 | 3 |
| 22. | | PCE | | Blockchain Technology | 3 | 0 | 0 | 3 |
| 23. | | PCE | | Cryptography and Network Security | 3 | 0 | 0 | 3 |
| 24. | | PCE | | Business Intelligence | 3 | 0 | 0 | 3 |

| Open Elective Courses(OEC) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SL. No | Semester | Course Category | Course Code | Name of the Course | Hours per week | | | Credit |
| | | | | | L | T | P | |
| 1. | | OEC | | Cyber Law and Ethics | 3 | 0 | 0 | 3 |
| 2. | | OEC | | Disaster Management | 3 | 0 | 0 | 3 |
| 3. | | OEC | | Human Resource Development | 3 | 0 | 0 | 3 |
| 4. | | OEC | | Knowledge Management | 3 | 0 | 0 | 3 |
| 5. | | OEC | | Intellectual Property Rights | 3 | 0 | 0 | 3 |
| 6. | | OEC | | Digital Marketing | 3 | 0 | 0 | 3 |
| 7. | | OEC | | Entrepreneurship | 3 | 0 | 0 | 3 |
| 8. | | OEC | | Japanese | 3 | 0 | 0 | 3 |
| 9. | | OEC | | German Primer | 3 | 0 | 0 | 3 |
| 10. | | OEC | | French Primer | 3 | 0 | 0 | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 11. | | OEC | | HR Management | 3 | 0 | 0 | 3 |
| 12. | | OEC | | Economic Policies in India | 3 | 0 | 0 | 3 |
| 13. | | OEC | | Organizational Behavior | 3 | 0 | 0 | 3 |
| 14. | | OEC | | Astro-Physics | 3 | 0 | 0 | 3 |
| 15. | | OEC | | Bioinformatics | 3 | 0 | 0 | 3 |
| 16. | | OEC | | Business Administration | 3 | 0 | 0 | 3 |
| 17. | | OEC | | Chemistry In Crime Investigation | 3 | 0 | 0 | 3 |
| 18. | | OEC | | Finance For Non Finance Managers | 3 | 0 | 0 | 3 |
| 19. | | OEC | | Fuel Cell And Batteries | 3 | 0 | 0 | 3 |
| 20. | | OEC | | Instrumental Methods Of Chemical Analysis | 3 | 0 | 0 | 3 |
| 21. | | OEC | | Keyboard | 3 | 0 | 0 | 3 |
| 22. | | OEC | | Logistics And Supply Chain | 3 | 0 | 0 | 3 |
| 23. | | OEC | | Nano Technology | 3 | 0 | 0 | 3 |
| 24. | | OEC | | Nuclear Physics | 3 | 0 | 0 | 3 |
| 25. | | OEC | | Panini Grammar | 3 | 0 | 0 | 3 |
| 26. | | OEC | | Plc Based Automation | 3 | 0 | 0 | 3 |
| 27. | | OEC | | Psychology | 3 | 0 | 0 | 3 |
| 28. | | OEC | | Violin | 3 | 0 | 0 | 3 |
| 29. | | OEC | | Vocal Music | 3 | 0 | 0 | 3 |
| 30. | | OEC | | Communication Skills | 3 | 0 | 0 | 3 |

| B.E(Hons.) Computer Science and Engineering with Specialization in IOT | | | | | | | |
|---|---|---|---|---|---|---|---|
| **SEMESTER - I (First year)** | | | | | | | |
| **SL. No** | **Course Category** | **Course Code** | **Name of the Course** | **Hours per week** | | | **Credit** |
| | | | | **L** | **T** | **P** | |
| 1. | BSC | | Mathematics – I (Calculus and Linear Algebra) | 3 | 1 | 0 | 4 |
| 2. | BSC | | Chemistry –I | 3 | 1 | 0 | 3 |
| 3. | ESC | | Basic Electrical Engineering | 3 | 1 | 0 | 3 |
| 4. | ESC | | Engineering Graphics and Design | 1 | 0 | 4 | 3 |
| 5. | BSC | | Chemistry Lab | 0 | 0 | 3 | 2 |
| 6. | ESC | | Basic Electrical Engineering Lab | 0 | 0 | 3 | 2 |
| 7. | MC | | English Proficiency Certification | 2 | 0 | 0 | 1 |
| **Total** | | | | | | | **18** |

| SEMESTER - II (First year) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **SL. No** | **Course Category** | **Course Code** | **Name of the Course** | **Hours per week** | | | **Credit** |
| | | | | **L** | **T** | **P** | |
| 1. | HSMC | | English | 2 | 0 | 2 | 3 |
| 2. | BSC | | Mathematics-II (Probability and Statistics) | 3 | 1 | 0 | 4 |
| 3. | BSC | | Physics – I (Semi Conductor and Physics) | 3 | 1 | 0 | 3 |
| 4. | ESC | | Programming for Problem Solving | 3 | 0 | 0 | 3 |
| 5. | MC | | Environmental Science | 2 | 1 | 0 | 2 |
| 6. | BSC | | Physics Lab | 0 | 0 | 3 | 2 |
| 7. | ESC | | Programming for Problem Solving Lab | 0 | 0 | 4 | 2 |
| 8. | ESC | | Workshop/Manufacturing Practices | 1 | 0 | 4 | 2 |
| **Total** | | | | | | | **21** |

| SEMESTER - III (Second year) | | | | | | | |
|---|---|---|---|---|---|---|---|
| SL. No | Course Category | Course Code | Name of the Course | Hours per week | | | Credit |
| | | | | L | T | P | |
| 1. | BSC | | Mathematics- III (Differential Calculus) | 4 | 1 | 0 | 4 |
| 2. | ESC | | Digital Electronics | 3 | 0 | 0 | 3 |
| 3. | PCC | | Data Structures and Algorithms | 3 | 0 | 0 | 3 |
| 4. | PCC | | Object Oriented Programming using C++ | 3 | 0 | 0 | 3 |
| 5. | | | Soft Skill – I | - | - | - | 1* |
| 6. | PSC | | Internet of Things: Architecture, Protocols and Applications | 3 | 0 | 0 | 3 |
| 7. | ESC | | Digital Electronics Lab | 0 | 0 | 3 | 2 |
| 8. | ESC | | Data Structures and Algorithms Lab | 0 | 0 | 3 | 2 |
| 9. | PCC | | Object Oriented Programming using C++ Lab | 0 | 0 | 3 | 2 |
| 10. | PCC | | Python Programming Lab | 0 | 0 | 3 | 2 |
| **Total** | | | | | | | **24** |

| SEMESTER - IV (Second year) | | | | | | | |
|---|---|---|---|---|---|---|---|
| SL. No | Course Category | Course Code | Name of the Course | Hours per week | | | Credit |
| | | | | L | T | P | |
| 1. | PCC | | Discrete Mathematics | 4 | 1 | 0 | 4 |
| 2. | PCC | | Computer Organization and Architecture | 3 | 0 | 0 | 3 |
| 3. | ESC | | Microprocessor and Microcontroller | 3 | 0 | 0 | 3 |
| 4. | PCC | | Design and Analysis of Algorithms | 3 | 0 | 0 | 3 |
| 5. | HSMC | | Management-I (Principles of Management) | 3 | 0 | 0 | 3 |
| 6. | MC | | Sanskrit and Indian Culture –I | 2 | 0 | 0 | 2 |
| 7. | | | Soft Skills- II | - | - | - | 1* |
| 8. | PSC | | Embedded Systems and Programs using Python Lab | 3 | 0 | 2 | 5 |
| 9. | PCC | | Computer Architecture Lab | 0 | 0 | 3 | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10. | ESC | | Microprocessor and Microcontroller Lab | 0 | 0 | 3 | 2 |
| 11. | PCC | | Design and Analysis of Algorithms Lab | 0 | 0 | 3 | 2 |
| 12. | PCC | | IT Workshop(Scientific Lab) | 0 | 0 | 3 | 2 |
| **Total** | | | | | | | **31** |

| **SEMESTER - V (Third year)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **SL. No** | **Course Category** | **Course Code** | **Name of the Course** | **Hours per week** | | | **Credit** |
| | | | | **L** | **T** | **P** | |
| 1. | PCC | | Automata Theory | 4 | 1 | 0 | 4 |
| 2. | PCC | | Operating Systems | 3 | 0 | 0 | 3 |
| 3. | PCC | | Programming in Java | 3 | 0 | 0 | 3 |
| 4. | PCC | | Database Management System | 3 | 0 | 0 | 3 |
| 5. | PEC | | Elective-I | 3 | 0 | 0 | 3 |
| 6. | | | Soft Skills- III | - | - | - | 1* |
| 7. | PSC | | IOT Security | 3 | 0 | 0 | 3 |
| 8. | PCC | | Operating Systems Lab | 0 | 0 | 3 | 2 |
| 9. | PCC | | Java Programming Lab | 0 | 0 | 3 | 2 |
| 10. | PCC | | Database Management System Lab | 0 | 0 | 3 | 2 |
| **Total** | | | | | | | **25** |

| **SEMESTER - VI (Third year)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **SL. No** | **Course Category** | **Course Code** | **Name of the Course** | **Hours per week** | | | **Credit** |
| | | | | **L** | **T** | **P** | |
| 1. | PCC | | Compiler Design | 3 | 0 | 0 | 3 |
| 2. | PCC | | Computer Networks | 3 | 0 | 0 | 3 |
| 3. | PCC | | Object Oriented Analysis and Design | 3 | 0 | 0 | 3 |
| 4. | PEC | | Elective-II | 3 | 0 | 0 | 3 |
| 5. | PEC | | Elective –III | 3 | 0 | 0 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6. | | | Soft Skills- IV | - | - | - | 1* |
| 7. | PSC | | Architecting smart IOT Devices | 3 | 0 | 0 | 3 |
| 8. | PCC | | Compiler Design Lab | 0 | 0 | 3 | 2 |
| 9. | PCC | | Computer Networks Lab | 0 | 0 | 3 | 2 |
| 10. | PCC | | Open CV Lab | 0 | 0 | 3 | 2 |
| 11. | PROJ | | Creative and Innovative Project | 0 | 0 | 0 | 3 |
| **Total** | | | | | | | **27** |

| **SEMESTER - VII (Final year)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **SL. No** | **Course Category** | **Course Code** | **Name of the Course** | **Hours per week** | | | **Credit** |
| | | | | **L** | **T** | **P** | |
| 1. | PEC | | Elective-IV | 3 | 0 | 0 | 3 |
| 2. | PEC | | Elective-V | 3 | 0 | 0 | 3 |
| 3. | OEC | | Open Elective – I | 3 | 0 | 0 | 3 |
| 4. | BSC | | Computational Biology | 2 | 1 | - | 3 |
| 5. | PSC | | Fog Computing & Energy Management in IOT Devices | 3 | 0 | 0 | 3 |
| 6. | PSC | | Web and Mobile Application Programming for IOT & Lab | 0 | 0 | 2 | 2 |
| 7. | PROJ | | Project work – Phase-I | - | - | - | 3 |
| 8. | PROJ | | Industrial Training & Practice | - | - | - | 2 |
| **Total** | | | | | | | **22** |

| **SEMESTER - VIII (Final year)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **SL. No** | **Course Category** | **Course Code** | **Name of the Course** | **Hours per week** | | | **Credit** |
| | | | | **L** | **T** | **P** | |
| 1. | | | Elective-VI | 3 | 0 | 0 | 3 |
| 2. | | | Open Elective –II | 3 | 0 | 0 | 3 |
| 3. | | | Open Elective –III | 3 | 0 | 0 | 3 |
| 4. | | | Project work – Phase-II | - | - | - | 10 |
| **Total** | | | | | | | **19** |

# SEMESTER-I

| Course Code : | MATHEMATICS – I (Calculus and Linear Algebra) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**OBJECTIVES**

- To familiarize the prospective engineers with techniques in calculus, multi-variable calculus and sequence and series.
- To equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics.

**Programme Outcomes (PO's)**

| UNIT | PROGRAMME OUTCOMES | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| 1 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| 2 | ✓ | ✓ | | ✓ | ✓ | | | | | | | |
| 3 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| 4 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| 5 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |

**UNIT – I CALCULUS**

Evaluation of definite and improper integrals- Beta and Gamma functions and their properties - Applications of definite integrals to evaluate surface areas and volumes of revolutions.

**UNIT – II NUMERICAL METHODS**

Solution of polynomial and transcendental equations – Bisection method-Newton-Raphson method-Regula-Falsi Method. Interpolation- Newton's forward and backward difference formulae- Interpolation with unequal intervals-Newton's divided difference and Lagrange's formulae-Numerical Differentiation.

**UNIT – III SEQUENCES AND SERIES**

Convergence of sequence and series-tests for convergence- Comparison test- D'Alembert's ratio test-Raabe's test-Logarithmic test- Cauchy's root test- Fourier series: Half range sine and cosine series-Parseval's theorem.

**UNIT – IV MULTIVARIABLE CALCULUS (DIFFERENTIATION)**

Limit-Continuity - Partial derivatives, total derivatives- Directional Derivatives-Tangent plane and normal line-Maxima, minima and saddle points-Method of Lagrange multipliers – Gradient Curl-Divergence.

**UNIT – V MATRICES**

Matrices: Rank of a matrix-rank-nullity theorem-System of linear equations- Symmetric matrices-Skew symmetric matrices- Orthogonal matrices; Eigen values and Eigenvectors-Cayley-Hamilton theorem-Diagonalization of matrices.

**TEXT BOOK**

B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 2000.

**REFERENCES**

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson, 2002.
2. T. Veerarajan, Engineering Mathematics, McGraw-Hill, New Delhi, 2008.
3. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill, New Delhi, 2010.
4. N.P. Bali and M. Goyal, A text book of Engineering Mathematics, Laxmi Publications,2010.
5. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2006.

| Course Code : | CHEMISTRY – I | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 3 |

**OBJECTIVE**

To learn the basics of atomic structure, bonding, analytical methods and various types of reactions in organic chemistry.

**OUTCOMES**

After the course the students will be able to

| Sl.No | Course Outcome | Bloom's Level |
|---|---|---|
| 1 | Realize the importance of knowledge in atomic structure and wave mechanics in studying the properties of elements | **K1,K2,K3,K4,K5** |
| 2 | Analyze and deduce the properties molecules on the basis of different bonding modes | **K1,K2,K3,K4** |
| 3 | Rationalize bulk properties and processes using thermodynamic considerations | **K1,K2,K3,K4,K5** |
| 4 | Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques | **K1,K2,K3,K4** |
| 5 | Understand the major types of chemical reactions and effect of three dimensional structures on the product of reactions | **K1,K2,K3** |

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | ✓ | ✓ | | | | | | | | | | |
| **CO2** | ✓ | ✓ | | | | | | | | | | |
| **CO3** | ✓ | ✓ | | | | | | | | | | |
| **CO4** | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | | | | |
| **CO5** | ✓ | ✓ | | | | | | | | | | |

**UNIT – I ATOMIC STRUCTURE**

Comparison between Rutherford's model of atom and Bohr's model - Bohr-Sommerfeld model (Concepts only)-its limitations - de Broglie theory-Heisenberg's uncertainty principle - Schrodinger's wave equation (derivation not needed)-significance of $\Psi$ and $\Psi^2$ – shapes of different orbital's –Aufbau principle-Pauli Exclusion Principle- Hund's rule. Electronic configuration of atoms- Mosley's law – Modern periodic table - periodic properties: atomic size- ionization energies- electron affinity- electro negativity.

**UNIT – II CHEMICAL BONDING**

Types of bonds – ionic - covalent – coordinate bond - Molecular Orbital Theory –types of molecular orbitals- energy level diagrams- e$^-$ns filling in MO – bond order – MO diagrams of $H_2$, $He_2$, $N_2$, $O_2$, CO and HF – molecules- Metallic bond – band theory of solids (primitive treatment only) and the role of doping on band structures - Hybridization – definition -

geometry of the molecules- $CH_4$, $C_2H_4$, $C_2H_2$ - Molecular forces-Ionic, dipolar, van der waals interactions.

**UNIT – III THERMAL AND ELECTROCHEMICAL EQUILIBRA**

Thermodynamic functions: State functions, Path functions, Internal energy, enthalpy, entropy and free energy-Gibbs Helmholtz equation and its applications. Feasibility of reaction - Ellingham diagrams.

Types of electrodes- Standard electrodes-Standard hydrogen electrode, standard calomel electrode, Single electrode potential, electrochemical series - galvanic cell - emf - Nernst equation and its applications - Glass electrode, Potentiometric acid base titrations and Solubility equilibria-Corrosion-types- Chemical corrosion-electrochemical corrosion-factors influencing and control measures.

**UNIT – IV SPECTROSCOPIC TECHNIQUES AND APPLICATIONS**

Electromagnetic radiations – wavelength – frequency – energy of a radiation – electromagnetic spectrum – changes brought about by the radiations - components of a spectrometer – rotational spectra of diatomic molecules – rigid and non-rigid rotor models (energy expressions only) - selection rule– schematic instrumentation – types of vibrations in molecules ($CO_2$, $H_2O$) – vibrational spectra(primitive treatment) – selection rule-instrumentation and applications – electronic transitions – electronic spectra - Beer-Lambert's law- instrumentation and applications – NMR – principle – chemical shift - instrumentation – NMR spectra of $CH_4$ – $CH_3OH$ – xylene isomers – MRI (Introduction only)

**UNIT – V STEREOCHEMISTRY & ORGANIC REACTIONS**

**Stereochemistry -** Representation of 3D structures **-** Fisher projection, Newman and Sawhorse projection formulae – Ethane, 3-bromo-2-butanol Conformation of Ethane, Butane & Ethylene glycol, , Symmetry and Chirality - Stereo isomers, Enantiomers, Diastereomers. Configuration - R-S system. Optical activity **-** Lactic acid, Tartaric acid-Geometrical isomerism – *cis-trans* & E-Z notations.

**Organic Reactions –** Substitution - $S_N1$ & $S_N2$ ( simple examples, mechanism not expected) – electrophilic substitutions – Friedel Crafts alkylations - Additions – 1,2-addition **–** types-addition of HX - Elimination – $E^1$ & $E^2$ (Examples only, mechanism not expected) - Oxidations – *cis*-hydroxylation with $OsO_4$, Reductions – Clemmensen & wolff-Kishner reductions, Cyclization – Diels Alder, Ring-Opening – Nylon-6 from caprolactum.

**Synthesis of most commonly used drugs –** Aspirin, Paracetamol.

**TEXT BOOKS**

1. Textbook of Inorganic Chemistry, P.L.Soni, Sultan Chand & Sons, Delhi, 2013. (For units I and II)
2. Principles of Physical Chemistry, B.R. Puri, L.R. Sharma and Madan S. Pathania, Shoban Lal Nagin Chand & Co., Jalandhar, 2000. (For units III and IV)
3. Advanced Organic Chemistry, B. S. Bahl and Arun Bahl, S.Chand, Delhi, 2012. (For unit V).

**REFERENCES**

1. Engineering Chemistry, P.C. Jain and Monika Jain, Dhanpat Rai Publishing Co Pvt. Ltd., New Delhi, 2008.
2. Applied Chemistry, K. Sivakumar, Anuradha Publications, Chennai, 2009.
3. Textbook of Engineering Chemistry, S.S.Dara & S.S. Umare, S.Chand, Delhi, 2004.
4. Fundamentals of Molecular Spectroscopy, C.N.Banwell and Elaine.M.McCash, 4th Edition, McGraw Hill Education, 2017.
5. Physical Chemistry, P. W. Atkins and Julio De Paula, 10th Edition, Oxford University Press,2014.

| Course Code : | BASIC ELECTRICAL ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 3 |

**OBJECTIVES**

To understand and analyze basic electric and magnetic circuits.
To study the working principles of electrical machines and power converters.
To introduce the components of low voltage electrical installations.

**COURSE OUTCOMES**

- To understand and analyze basic electric and magnetic circuits.
- To study the working principles of electrical machines and power converters. To introduce the components of low voltage electrical installations.

**CO1:** Explain the basic electrical quantities and laws.
**CO2:** Explain the construction, types and applications of electrical machines.
**CO3:** Study the working principles of power converters.
**CO4:** Show the tariff for a given load and energy consumption.
**CO5:** Introduce the components of low voltage electrical installations and its applications.

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | L | L | M | M | M | - | S | M | - | S |
| CO2 | S | S | M | M | M | S | M | L | S | M | L | M |
| CO3 | S | S | M | M | S | M | M | - | M | M | - | M |
| CO4 | S | S | S | S | S | M | M | M | M | M | L | M |
| CO5 | S | S | M | S | M | M | L | L | S | M | L | M |

S -STRONG, M- MEDIUM, L- LOW

**UNIT – I DC CIRCUITS**

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

**UNIT – II AC CIRCUITS**

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

**UNIT – III ELECTRICAL MACHINES**

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working,

Torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.
Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

**UNIT – IV POWER CONVERTERS**

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

**UNIT – V ELECTRICAL INSTALLATIONS**

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries.
Elementary calculations for energy consumption, power factor improvement and battery backup.

**TEXT BOOKS**

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.

**REFERENCES**

1. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
2. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
3. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

| Course Code : | ENGINEERING GRAPHICS AND DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 4 | 3 |

**OBJECTIVES**

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

**OUTCOMES**

On successful completion of this course, the student will be able to

- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modeling
- Exposure to computer-aided geometric design
- Exposure to creating working drawings

Exposure to engineering communication

**TRADITIONAL ENGINEERING GRAPHICS**

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

**COMPUTER GRAPHICS**

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM).

**(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)**

**UNIT - I INTRODUCTION TO ENGINEERING DRAWING**

covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

**UNIT - II ORTHOGRAPHIC PROJECTIONS**

Covering, Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

**UNIT - III PROJECTIONS OF REGULAR SOLIDS**

Covering, those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc

**UNIT - IV SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS**

covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

**UNIT – V ISOMETRIC PROJECTIONS**

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

**UNIT - VI** Overview of Computer Graphics-theory of CAD software-Drawing Area, Dialog boxes and windows- Different methods of zoom as used in CAD-Isometric Views of lines, Planes, Simple and compound Solids- Customisation & CAD Drawing-ISO and ANSI standards for coordinate dimensioning and tolerancing; dimensions to objects-various ways of drawing circles, Annotations, layering & other functions-Setting up and use of Layers, layers to create drawings-color coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling-Introduction to Building Information Modelling (BIM)

**Sl No List of Experiments**

I. Introduction to engineering design (CAD)
II. Introduction to Auto cad
III. Introduction to BIM

1. Drafting and modelling with co-ordinate systems
2. Creation of a simple machined component
3. Creation of title block
4. Creation of orthographic views of a cone, cylinder and hexagon
5. Creation of sectional views of a cone, cylinder and hexagon
6. Creation of orthographic views
7. Creation of isometric view of a V-block.
8. Conversion of 3D to 2D drawings
9. Creation of 3D solid machine component
10. Creation of 3D solid V block
11. Building plan of a simple office
12. Building plan of a simple home
13. Creation of simple steel truss

**TEXT BOOKS**

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House.
2. Shah, M.B. & Rana B.C. (2010), Engineering Drawing and Computer Graphics, Pearson Education.

**REFERENCES**

1. Agrawal B. & Agrawal C. M. (2017), Engineering Graphics, TMH Publication.
2. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
3. AUTO CAD User Manual.

| Course Code : | CHEMISTRY LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 2 |

**OBJECTIVES**

To learn the basics and perform experiments involving volumetric analysis, colligative properties, simple synthesis and other instrumental techniques.

**OUTCOMES**

After the course the students will be able to

- Estimate rate constants of reactions from concentration of reactants/products as a function of time.
- Measure molecular/system properties such as, conductance of solutions, redox potentials, and chloride content of water.
- Analyze a salt sample.
- Know the determination of physical properties such as adsorption and viscosity.
- Acquire the practical skills for the separation of compounds through the chromatographic techniques.

**Any ten experiments of the following**

1. Determination of surface tension and viscosity of a liquid or a solution
2. Thin layer chromatography / Paper chromatography for separation of a mixture.
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water by volumetry.
5. Determination of M.wt of a non-volatile solute by Rast's method.
6. Determination of the rate constant of the reaction between $K_2S_2O_8$ and KI – Clock reaction method.
7. Conductometry -Verification of Debye-Huckel-Onsager equation for a strong electrolyte.
8. Potentiometry - Determination of formal redox potential of $Fe^{3+}/Fe^{2+}$ couple
9. Synthesis of Nylon 66 by interfacial polymerization method.
10. Determination of Saponification/acid value of oil.
11. Systematic qualitative analysis of a salt
12. Lattice structures and packing of spheres
13. Models of potential energy surfaces – computational experiment.
14. Chemical oscillations- Potentiometric study of the oscillations of Belousov-Zhabotinsky reaction
15. Determination of the partition coefficient of $I_2$ between water and $CCl_4$
16. Verification of Freundlich isotherm for adsorption of acetic acid / oxalic acid by charcoal.
17. Determination of isoelectric point of Gelatin sols by using capillary viscosmeter.

**TEXT BOOKS**

1. Advanced Practical Physical Chemistry, J.B.Yadhav, Krishna Prakasan Media, 2016.
2. Experiments in Applied Chemistry, Sunita Rattan, S.K. Kataria& Sons, 2012

| Course Code : | BASIC ELECTRICAL ENGINEERING LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 2 |

**OBJECTIVES**

To understand and analyze basic electric and magnetic circuits.
To study the working principles of electrical machines and power converters.
To introduce the components of low voltage electrical installations.

**COURSE OUTCOMES**

- To understand and analyze basic electric and magnetic circuits.
- To study the working principles of electrical machines and power converters. To introduce the components of low voltage electrical installations.

After the successful completion of the course students will be able to

**CO1:** Obtain load characteristics of Single Phase Induction Motor, Three Phase Induction Motor, Single Phase Transformer and Three Phase Alternator

**CO2:** Obtain Speed Control of DC Motor, Three Phase Induction Motor (Pole Changing Method)

**CO3:** To demonstrate the working of Multi meter, CRO and LCR Meter and Measurement of Voltage, Current and Power.

**CO4:** To Verify experimentally Kirchoff‟s Law and Thevenin‟s Theorem

**CO5:** Obtain the B•H Curve of a Magnetic Material

**CO6:** Analysis of RLC circuit

**CO7:** Analysis of Converter circuit

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | M | M | M | M | - | - | S | M | - | L |
| CO2 | S | S | M | M | S | M | L | - | S | S | - | M |
| CO3 | S | S | M | M | S | M | L | - | S | M | L | M |
| CO4 | S | S | S | S | M | M | L | L | M | M | - | S |
| CO5 | M | M | M | S | M | M | L | - | M | M | - | M |
| CO6 | S | S | M | M | M | M | - | - | M | M | - | M |
| CO7 | S | S | M | M | M | M | - | - | M | M | - | M |

S -STRONG, M- MEDIUM, L- LOW

**LIST OF EXPERIMENTS**

1. Study of Electric Motors (AC & DC Motors).
2. Load Test on Single Phase Induction Motor.
3. Load Test on Three Phase Induction Motor.
4. Load Test on Single Phase Transformer.
5. Load Test on Three Phase Alternator.
6. Speed Control of DC Motor.
7. Speed Control of Three Phase Induction Motor (Pole Changing Method).
8. Study of Multi meter, CRO and LCR Meter.

9. Measurement of Voltage, Current and Power.
10. Verification of Kirchoff's Law.
11. Verification of Thevenin's Theorem.
12. B·H Curve of a Magnetic Material.
13. Rectifier Circuit Analysis (AC – DC).
14. Inverter Circuit Analysis (DC – AC).
15. Chopper Circuit Analysis (DC – DC).
16. Series and Parallel RLC Circuit Analysis.

**Text Books**

D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.

**References**

L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.

**Online resources**

1. www.nptl.co.in
2. www.electrical4u.com

# SEMESTER-II

| Course Code : | ENGLISH | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**UNIT – I VOCABULARY BUILDING**

1.1 The concept of Word Formation
1.2 Root words from foreign languages and their use in English
1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
1.4 Synonyms, antonyms, and standard abbreviations.

**UNIT – II BASIC WRITING SKILLS**

2.1 Sentence Structures
2.2 Use of phrases and clauses in sentences
2.3 Importance of proper punctuation
2.4 Creating coherence
2.5 Organizing principles of paragraphs in documents
2.6 Techniques for writing precisely

**UNIT – III IDENTIFYING COMMON ERRORS IN WRITING**

3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions
3.6 Redundancies
3.7 Clichés

**UNIT – IV NATURE AND STYLE OF SENSIBLE WRITING**

4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion

**UNIT – V WRITING PRACTICES**

5.1 Comprehension
5.2 Précis Writing
5.3 Essay Writing

**PRACTICE: ORAL COMMUNICATION**

(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

**REFERENCES**

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

| Course Code : | MATHEMATICS - II (Probability And Statistics) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**OBJECTIVES**

- To familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables.
- To equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

**Programme Outcomes (PO's) & Course Outcomes - Mapping**

| UNIT | PROGRAMME OUTCOMES | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| 1 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| 2 | ✓ | ✓ | | ✓ | ✓ | | | | | | | |
| 3 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| 4 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| 5 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |

**UNIT – I MULTIVARIABLE CALCULUS (INTEGRATION)**

Multiple Integration: Double and Triple integrals (Cartesian) - Change of order of integration in double integrals - Problems on Green, Gauss and Stokes theorems.

**UNIT – II ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDERS**

Operator D – Rules for finding complementary function – Rules for finding particular integral - Second order linear differential equations with variable coefficients: Cauchy-Euler equation - Method of variation of parameters.

**UNIT - III PARTIAL DIFFERENTIAL EQUATIONS OF HIGHER ORDERS**

Definition of Partial Differential Equations- Formation of Partial differential equations, solutions of a Partial differential equation -Linear equations of the first order - Solution to homogenous and non-homogenous linear partial differential equations of second order by complementary function and particular integral method.

**UNIT – IV COMPLEX VARIABLE – DIFFERENTIATION**

Differentiation - Cauchy-Riemann equations - Analytic functions - Harmonic functions, Finding Harmonic conjugate - Conformal mappings: $z+c$, $1/z$, $cz$, $z^2$, $z+1/z$, $e^z$ - Mobius transformations and their properties.

**UNIT-V COMPLEX VARIABLE – INTEGRATION**

Contour integrals: Cauchy - Goursat theorem (without proof) - Cauchy Integral formula (without proof) - Taylor's series - Laurent's series - Zeros of analytic functions –singularities – Residues - Cauchy Residue theorem (without proof) – Simple problems.

**TEXT BOOKS**

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

**REFERENCES**

1. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
2. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

| Course Code : | ENGINEERING PHYSICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 3 |

**PRE-REQUISITES**

Basic knowledge of Physics theory in higher secondary level.

**OBJECTIVES**

The student will acquire knowledge on:

1. Theory of Interference- Newton's rings, Michelson Interferometer, Fresnel and Fraunhoffer diffraction, Diffraction due to "n" slits – Plane Transmission grating.
2. Energy distribution in black body-Planck's law, De Broglie matter waves – dual nature and expression, Schrodinger Time Independent and Dependent, wave equation, Expression for particle in 1-D box and applications.
3. Laser-Principles and Properties, Einstein's theory, Types of lasers – Nd:YAG and CO2 laser Applications of lasers – IR Thermography, Optical fibers- Types of optical fibers, Acceptance angle and numerical aperture, Fiber losses, Applications in engineering and medicine.
4. PN Junction diode and Zener diode - V-I characteristics, BJT, SCR, FET, D-MOSFET, E-MOSFET Characteristics, Characteristics of CMOS, Logic Gates and Universal Building Blocks.
5. Fundamentals of dielectric materials, Internal field and Clausius-Mossotti relation, Superconductors – properties and types - BCS theory, Nanomaterials – Synthesis, Ball milling and PVD method. Principle and properties of SMA and Biomaterials.

**COURSE OUTCOMES**

**CO1:** To develop an understanding of the principles of optics.

**CO2:** Experience the diverse applications of the wave equation. Learn the mathematical tools needed to solve quantum mechanics problems.

**CO3:** To provide adequate knowledge on laser fundamentals types and applications and to expose the basics of signal propagation through fiber optics

**CO4:** Understand the principles and concepts of semiconductor Physics. Understand and utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems.

**CO5:** Acquire basic knowledge on various newly developed smart materials

**Mapping of POs and COs.**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | - | - | x | - | - | - | x | - | - | - | - |
| CO2 | x | - | - | x | - | - | - | x | - | - | - | - |
| CO3 | x | - | - | x | - | - | - | x | - | - | - | - |
| CO4 | x | - | - | x | - | - | - | x | - | - | - | - |
| CO5 | x | - | - | x | - | - | - | x | - | - | - | - |

**UNIT I – WAVE OPTICS**

Huygens' principle, superposition of waves –Theory of interference of light -Young's double slit experiment.Thin films- Newton's rings, Michelson interferometer-Anti reflection coating.Fresnel and Fraunhofer diffraction– diffraction due to 'n' slits- plane transmission grating. Rayleigh criterion for limit of resolution - resolving power of grating

**UNIT -II - QUANTUM PHYSICS**

Black body radiation-Planck's law – Energy distribution function, Wave – particle duality-de Broglie matter waves – Concept of wave function and its physical significance – Heisenberg's Uncertainity Principle – Schrodinger's wave equation – Time independent and Time dependent equations – Particle in a one dimensional rigid box – tunneling (Qualitative) – Scanning tunneling microscope.

**UNIT III – PHOTONICS**

Einstein's theory of matter radiation interaction and A and B coefficients;Properties of laser-spontaneous and stimulated emission, amplification of light by population inversion, different types of lasers: solid-state laser(Neodymium), gas lasers ($CO_2$), applications –IR Thermography.
Optical fibre- principle [TIR]-types-material, mode, refractive index-Fibre loss-Expression for acceptance angle and numerical aperture. Application-Communication.

**UNIT IV - SEMICONDUCTOR DEVICES AND APPLICATIONS**

Introduction to P-N junction Diode and V-I characteristics, Zener diode and its characteristics,
Introduction to BJT, its input-output and transfer characteristics, SCR characteristics, FET, MOSFET and CMOS characteristics. Basic logic gates - NAND, NOR as Universal building block.

**UNIT V – NEW ENGINEERING MATERIALS**

Dielectric materials:Definition – Dielectric Breakdown – Dielectric loss – Internal field – ClaussiusMossotti relation.
Superconducting materials:Introduction – Properties-Meissner effect – Type I & Type II superconductors – BCS theory-Applications.
Nanomaterials:Introduction – Synthesis of nano materials – Top down and Bottom up approach- Ball milling- PVD method- Applications.
Smart materials: Shape memory alloys-Biomaterials (properties and applications)

**TEXT BOOKS**

1. Optics by Subramaniam N &BrijLal, S Chand & Co. Pvt. Ltd., New Delhi, [unit 1]
2. Modern Physics by R Murugeshan, Kiruthiga, Sivaprasath S Chand [all units]
3. Quantum Mechanics by Sathyaprakash, PragatiPrakashan, Meerut. [unit 2]
4. Applied Engineering Physics – Rajendran & Marikani (Tata McGraw Hill) [unit 3,5] 2009

5. Engineering Physics – Bhattacharya, Bhaskaran – Oxford Publications [unit 2,3,5] 2012
6. Engineering Physics I & II – G.Senthilkumar, VRB publications [unit 2,3] 2012
7. Applied Physics for Engineers – K.Venkatramanan, R.Raja, M.Sundarrajan(Scitech)[3,5] 2014
8. Principles of Electronics by V.K.Mehta, (S.Chand) [unit 5]

**REFERENCE BOOKS**

1. Fundamentals of Optics by Jenkins A Francis and White E Harvey, McGRaw Hill Inc., New Delhi,
2. Quantum Mechanics by V. Devanathan, Narosa, Chennai.
3. Engineering Physics by M.N.Avadhanulu, S.Chand& Company Ltd.
4. Concepts of Modern Physics by Arthur Beisser, McGraw Hill, 7th edition.
5. Optics byR.Agarwal, S.Chand publishers.
6. Basic Electronics by B.L.Theraja, S.Chand publishers.
7. Fundamentals of Physics, 6th Edition, D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, New York.

| Course Code : | PROGRAMMING FOR PROBLEM SOLVING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITES**
Basic Knowledge of Computer Science

**OBJECTIVES**

- The course is designed to provide complete knowledge of C
- To Provide Students an exposure to gain the knowledge
- To Ensure That Students begin To learn the concepts of basic programming
- To design a creative solution for real world problems.
- To develop awareness of learning the basic concepts and creating algorithms.

**COURSE OUTCOMES**
**CO1:** Makes students gain a broad perspective about the uses of computers in the engineering industry.
**CO2:** Develops a basic understanding of computers, the concept of algorithm and algorithmic thinking.
**CO3:** Develops the ability to analyze a problem, develop an algorithm to solve it.
**CO4:** Develops the use of the C programming language to implement various algorithms, and develops the basic concepts and terminology of programming in general.
**CO5:** Introduces the features of data structures in this C Programming language

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | | | | | | | | | | | |
| CO2 | | M | | | | | | | | | | |
| CO3 | | | | | S | | | | | | | |
| CO4 | | | | S | | | | | | | | L |
| CO5 | L | | | | S | | | | | | L | |

S - STRONG, M - MEDIUM, L - LOW

**UNIT – I**

Introduction to components of computer system-Generation of programming languages-Types of Computers-Organization of Computers-Types of memory, Number systems-Idea of Algorithm-Pseudo code- Flow Chart with examples.

**UNIT - II**

Introduction to C-Character set, Constants, Variables, Data Types-Operators – Arithmetic expressions and precedence-Decision Making statement - Looping statements.

**UNIT -III**

Arrays and its types-Functions –Parameter passing in functions-call by value- call by reference – Passing array to functions-Recursive function.

**UNIT - IV**

Structures and array of structures –Union, Basic searching –Linear and Binary, Basic sorting, String operations.

**UNIT - V**

Introduction to Pointer, Pointer arithmetic-notion of linked list- File handling.

**TEXT BOOKS**

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
2. Balagurusamy. E, "Programming in ANSI C", Tata McGraw Hill, Third edition, 2006.
3. Fundamentals of Computing and Programming- V.Ramesh Babu, R.Samyuktha, M.Muniratham by VRB Publishers 2012 edition.

**REFERENCE BOOKS**

1. Let Us 'C' - Yashawant Kanetkar, (Unit 2 to 5), BPB publications, 10th Edition, 2010.
2. Ashok N Kamthane, "Computer Programming", Pearson education, Second Impression, 2008.
3. Venugopal.K and Kavichithra.C, "Computer Programming", New Age International Publishers, First Edition, 2007.
4. Kernighan B.W and Ritchie,D.M , The C programming language: second edition, Pearson education,2006

| Course Code : | ENVIRONMENTAL SCIENCE | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 1 | 0 | 2 |

**OBJECTIVE:**

- To familiarize the students with basic concepts of environment
- To understand their role and responsibility of an individual in the environmental conservation.

| No | Course Outcome | Bloom's Level |
|---|---|---|
| **1.** | Understand the individual responsibility towards environment | **K1,K2,K3,K4,K5** |
| **2.** | Create Eco-centrism approach towards sustainable society | **K1,K2,K3,K4** |
| **3.** | Enable the learners to understand, think and evolve strategies for management and conservation of environment for sustaining life on earth. | **K1,K2,K3,K4,K5** |
| **4.** | Develop a new solution towards various environmental problems | **K1,K2,K3,K4** |
| **5.** | Understand the current environmental trends of India and the world and about environmental legislation | **K1,K2,K3,K4** |

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | ✓ | ✓ | ✓ | | | | | | | |
| CO2 | ✓ | | ✓ | ✓ | | | | | | |
| CO3 | ✓ | ✓ | ✓ | | | | | | | |
| CO4 | ✓ | ✓ | | ✓ | | ✓ | | | | |
| CO5 | ✓ | ✓ | | | | | | ✓ | ✓ | |

**UNIT – I INTRODUCTION TO ENVIRONMENT AND ENVIRONMENTAL STUDIES**

Introduction to environment – components – nature of environment - need of awareness – reasons for environmental problems – anthropocentric and eco centric views.

Environmental studies - multidisciplinary nature – scope and aim – sustainable development- principles – RRR concept-Indian environmental movements – environmental calendar.

**UNIT – II ECOSYSTEM AND BIODIVERSITY**

Ecosystem – structure – functions – simplified ecosystem models (food chain and food webs and their types,energy flow) - forest – grassland – pond –ecosystems – ecological succession - ecological pyramids – Bio-geochemical cycles of water – oxygen-carbon-phosphorous and sulphur.

Biodiversity – definition – types – species – genetic and ecosystem diversities- values of biodiversity – threats to biodiversity – conservation of biodiversity – endemism – biodiversity hotspots – Indian biodiversity– endemic species of India – IUCN lists -red-green and blue data books.

**UNIT – III NATURAL RESOURCES**

Natural resources – definition – types – forest resources – uses –deforestation- reasons - effects –water resources – dams – effects of dams - food resources – modern agriculture– ill effects -energy resources- types – hydel –nuclear – solar –wind and biomass energy - world scenario – Indian scenario.

Population and environment – reasons for over exploitation of resources – population – demography – population curves – population explosion – effects – consumerism – effects – urbanization – reasons and effects- role of an individual.

**UNIT – IV ENVIRONMENTAL POLLUTION**

Pollution – definition – types – air pollution – causes and effects – effects of $CO_2$ – CO – NOx – SOx – particulates – control of air pollution – water pollution – causes – effects – remedies – soil pollution – solid waste management – e waste – ill effects of e-waste – proper recycling- Noise pollution – reasons – effects – control – nuclear pollution – cases – effects and control –thermal pollution causes – effects and remedies.

Legal provisions for protecting environment – article 48 A – 51 A (g) – Environment act 1986 – Air act 1981 – Water act 1974 – wild life protection act – Forest act 1980- problems in implementation–reasons.

**UNIT – V SOCIAL ISSUES AND ENVIRONMENTAL ETHICS**

Present environmental scenario – green house effect – climate change – The Kyoto Protocol – ozone layer depletion-The Montreal Protocol - acid rain – causes – effects - disparity among the nations – The Copenhagen UNFCCC summit – carbon currency- virtual water- genetically modified organisms, Disaster management.

Environmental ethics – introduction – people getting affected - resettlement and rehabilitation – issues involved –Sardhar Sarovar project – Tawa Matsya sang - Melting icebergs of Arctic.

**TEXT BOOK**

1. Anubha Kaushik and C.P. Kaushik, ”Prospects of Environmental Science”, New Age International publishers, 2013.

**REFERENCES**

1. Environmental Studies, N. Nandini, N. Sunith a and Sucharita Tandon, Sapna Book House, 2007.
2. Text book of Environmental Science, Ragavan Nambiar, Scitech Publications, 2009.
3. Text book of Environmental Chemistry and Pollution Control, S.S.Dara, S.Chand and Co., 2002.
4. Environmental Chemistry, Colin Baird, W.H.Freeman and company, New York,1999.
5. Environmental Chemistry, Gary W. VanLoon and Stephen J.Duffy, Oxford University Press, 2000.
6. New Trends in Green Chemistry, V.K. Ahluwalia and M. Kidwai, Anamaya Publishers, 2006.

| Course Code : | PHYSICS LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 2 |

**OBJECTIVES**

Engineering Physics laboratory course provides real time experience in handling equipments and measurement techniques. Basic objective of the course is to learn the experimental procedure and execution expertise in engineering practices.

**COURSE OUTCOMES**

**CO1:** Demonstrate the procedural preparation skill to conduct the experiment
**CO2:** Ability to perform the experiment and tabulate the observations made.
**CO3:**Skill to obtain an expected experimental out-comes by different techniques and impart practical knowledge in real time solution.
**CO4:** Interpretation of experimental results and conclusions.
**CO5:** Understand principle, concept,working and applications of new theory and articulation of the relevant theory.

**Mapping of POs and COs.**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | - | - | x | - | - | x | x | x | x |
| CO2 | x | - | - | x | - | - | x | x | x | x |
| CO3 | x | - | - | x | - | - | x | x | x | x |
| CO4 | x | - | - | x | - | - | x | x | x | x |
| CO5 | x | - | - | x | - | - | x | x | x | x |

**Contents:**

1. Determination of radius of curvature of convex lens by Newton's rings experiment.
2. Determination of the wavelength of spectral lines using plane diffraction grating by minimum deviation method.
3. Determination of numerical aperture and acceptance angle of an optical fiber.
4. Determination of the number of lines in grating.
5. Verification of truth tables of Basic Logic Gates.
6. Verify NAND as Universal Building Block.
7. Verify NOR as Universal Building Block.
8. To study the V-I characteristics of Zener diode.

| Course Code : | PROGRAMMING FOR PROBLEM SOLVING LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**PRE-REQUISITES**

Basic Knowledge of Computer Science

**OBJECTIVES**

- The course aims to provide exposure to problem-solving through programming.
- To ensure that students begin to understand the fundamentals of Computer programming.
- To be able to effectively choose programming components to solve computing problems in real-world.
- To be able to formulate problems and implement in Computer programming.
- Learning the basic programming constructs they can easily switch over to any other language in future.

**COURSE OUTCOME**

- Know the basic concepts in problem solving
- Demonstrate the algorithm and flow chart for the given problem
- Design and develop the program to evaluate simple expressions and logical operations.
- To write creative solutions using C language
- Design and develop solutions to real world problems.

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | M | S | | M | | | | |
| CO2 | | | | | | | | M | S | S | M | |
| CO3 | | | | | | M | | | | S | | |
| CO4 | | | | | | | | S | S | M | | S |
| CO5 | | | | | | | | S | | | | |

S-STRONG, M -MEDIUM, L- LOW

**LIST OF EXERCISE**

1. Basic programs in data types.
2. Evaluate Expressions using library Function.
   a. $\pi r^2$
   b. (A+B+(2C/3A)+A2+2B)
   c. $\sqrt{S(S-A)\ (S-B)\ (S-C)}$
   d. LOG $(x^3+y^3+z^3)$
3. Problems in Decision making statements.
   i. Find the Biggest among 3 numbers.
   ii. Find Even or odd
   iii. Arithmetic operations using Switch - Case Statements.
4. Problems in looping statements.
   i. Find the Sum of series using (i) For loop (ii) While loop
   ii. Generate the Fibonacci series
   iii. Check whether the number is prime or not.

5. Find the Linear Search.
6. Bubble sort and Insertion sort.
7. Matrix Manipulation-Addition, Subtraction and Multiplication.
8. String operations-string copy, string reverse, string concatenate.
9. Swapping of numbers using call by value, call by reference.
10. Find factorial using recursive functions.
11. Numerical methods-Quadratic Equation.
12. Display the student information & marks using Structure & Unions.
13. Demonstrate array of structures.
14. Pointer Arithmetic and Array access using Pointers.
15. Basic File Operations

| Course Code : | WORKSHOP/MANUFACTURING PRACTICES | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 4 | 2 |

**OBJECTIVES**

To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

**OUTCOMES**

On successful completion of this course, the student will be able to

- fabricate carpentry components and pipe connections including plumbing works.
- use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate the operations of smithy, foundary and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities

**Lectures & videos: (10 hours)**

**Detailed contents**

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods **(3 lectures).**
2. CNC machining, Additive manufacturing **(1 lecture)**
3. Fitting operations & power tools **(1 lecture)**
4. Electrical **(1 lecture)**
5. Carpentry **(1 lecture)**
6. Plastic moulding, glass cutting **(1 lecture)**
7. Metal casting **(1 lecture)**
8. Welding (arc welding & gas welding), brazing **(1 lecture)**

**LIST OF EXERCISE**

| Sl. No | Manufacturing/ Fabrication lab | Experiment Name |
|---|---|---|
| 1 | Machine Shop | Turning and facing practice |
| | | Step turning |
| | | Drilling practice |
| | | Preparation of bottle using blow moulding machine |
| | | Preparation of given glass profile using diamond glass cutter |
| | | Sheet metal jobs |
| 2 | Fitting Shop | V- fitting |
| | | Square fitting |
| 3 | Carpentry Shop | Planning practice |
| | | Half lap T- joint |
| | | Half lap cross joint |
| 4 | Welding Shop | Straight bead welding |
| | | Butt joint – gas welding process |
| | | Lap joint - arc welding process |
| 5 | Smithy Shop | Fabrication of square rod |
| 6 | Casting | Preparation of green sand mold using a gland piece pattern |
| 7 | Electrical Lab | Two lamps in series controlled by one-way switch |
| | | Two lamps in parallel controlled by one-way switch |
| 8 | Civil work | Simple Plumbing exercises |

**Text Books**

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2018.
3. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.

**References**

1. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
2. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House 2017.

# SEMESTER-III

| Course Code : | MATHEMATICS- III (Differential Calculus) | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 1 | 0 | 4 |

**COURSE OUTCOMES**

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

**Programme Outcomes (PO's) & Course Outcomes - Mapping**

| UNIT | PROGRAMME OUTCOMES | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| 1 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| 2 | ✓ | ✓ | | ✓ | ✓ | | | | | | | |
| 3 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| 4 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| 5 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |

**UNIT - I MULTIVARIABLE CALCULUS (INTEGRATION)**

Multiple Integration: Double and Triple integrals (Cartesian), Change of order of integration in double integrals, Problems on Green, Gauss and Stokes theorems.

**UNIT - II ORDINARY DIFFERENTIAL EQUATIONS**

Exact, linear and Bernoulli's equations-Operator D – Rules for finding complementary function – Rules for finding particular integral-Second order linear differential equations with variable coefficients - Cauchy-Euler equation.

**UNIT – III SERIES SOLUTION AND SPECIAL FUNCTIONS**

Validity of series solution - Series solution when x=0 is an ordinary point - Frobenius method (Series solution when x=0 is a regular singularity) - Bessel's equation - Recurrence formulae for Jn(x) - Generating function for Jn(x) - Equations reducible to Bessel's equation – Orthogonality of Bessel functions -Legendre's Equation – Rodrigue's Formula – Legendre Polynomials – Generating Function for $P_n(x)$- Recurrence formula for $P_n(x)$-Orthogonality of Legendre Polynomials

**UNIT - IV PARTIAL DIFFERENTIAL EQUATIONS**

First order partial differential equations, solutions of first order linear and non-linear PDEs. Solution to homogenous and non-homogenous linear partial differential equations second and higher order by complimentary function and particular integral method.

**UNIT - V APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS**

Method of separation of variables – Vibration of a stretched string: Wave equation – Solution of Wave equation - D'Alembert's solution of wave equation – One dimensional heat flow – Solution of heat equation.

**TEXT BOOKS**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill

| Course Code : | DIGITAL ELECTRONICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

Basic Electronics.

**OBJECTIVES**

The course should enable the students to:

1. Study various number systems and to simplify the mathematical expressions using Boolean functions – simple problems.
2. Study implementation of combinational circuits.
3. Study the design of various synchronous and asynchronous circuits.
4. Learn about the State reduction techniques & various hazards present in the circuit
5. Expose the students to various memory devices and to Design the Digital circuits using HDL programming.

**COURSE OUTCOME**

The students should be able to:

1. Understand the basic number system and Boolean algebra.
2. Understand the basics of combinational and Sequential circuits.
3. Know about Flip flops and their designing.
4. Analyze about State reduction techniques and various hazards present in the circuit.
5. Understanding the concepts of VHDL programming for designing Digital circuits.

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L | M | M | H | | | | M | | |
| CO2 | L | M | M | H | | | L | M | | |
| CO3 | L | M | L | H | | | | L | L | |
| CO4 | L | H | M | M | | M | | L | M | M |
| CO5 | L | M | M | M | | M | | M | M | |

S -STRONG, M- MEDIUM, L- LOW

**UNIT - I NUMBER SYSTEMS & BOOLEAN ALGEBRA**

**Number Systems & Boolean Algebra:** Introduction to Number Systems & Conversions - Boolean algebra – Logic Gates & operations – Boolean Laws - Minimization of Boolean expressions - Boolean expressions and Logic Diagrams -Universal building blocks - Negative logic.

**Logic Simplifications**: Truth tables and maps - Sum of products (SOP) and Product of Sum (POS) - Simplification of logic functions using Karanaugh map - Minimization and Quine-McCluskey method of minimization.

**UNIT – II COMBINATIONAL CIRCUITS**

**Arithmetic Circuits:** Half Adder, Full Adder, Half Subtractor & Full Subtractor, Number complements. Multiplexer & Demultiplexer, Decoder and Encoder

**Code converters**: BCD to Excess3, Gray, Seven Segment Display Conversions – Parity Generator and Checkers.

**UNIT - III SYNCHRONOUS SEQUENTIAL CIRCUITS**

Basic latch circuits - Flip-flops, Truth table and excitation table- Analysis of Clocked Sequential circuits- Shift Registers.

**Counters:** Synchronous counter design using JK, T, D flip flops, Up-down counter, BCD counter and Ring counters.

**UNIT - IV ASYNCHRONOUS SEQUENTIAL LOGIC**

Analysis and Design of Asynchronous Sequential Circuits-Reduction of State and Flow Tables- Multiple Inputs- Race free State Assignment- Hazards

**UNIT- V LOGIC FAMILIES AND PROGRAMMABLE LOGIC DEVICES**

**HDL Programming:** Introduction to HDL Programming, HDL for Combinational Circuits, HDL for sequential logic circuits.

**Programmable Logic Devices:** Programmable Logic Array (PLA)-Programmable Array Logic (PAL) - PROM.

**TEXT BOOKS**

1. W.H. Gothmann, "Digital Electronics - An Introduction, Theory and Practice", Prentice Hall of India. 2nd Edition 2000
2. M. Morris Mano, "Digital Design", 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003..
3. Frank Vahid "VHDL for Digital Design-With RTL design, VHDL & Verilog"- John Wiley & Sons, 2010
4. Jain—Modern Digital Electronics, 2/e ,TMH

**REFERENCE BOOKS**

1. Anand Kumar, "Switching Theory and Logic Design" – PHI, PHI, 2nd Edition 2014.
2. Heiser Man, "Handbook of Digital IC applications", Prentice Hall. 200
3. D.J. Comer, "Digital Logic and State Machine Design" HOLT-SAUN-DERS 3rd Edition, 2012
4. T.L. Floyd & Jain, "Digital Fundamentals", Pearson, 10 Edition, 2010
5. John F.Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 200
6. Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.

| Course Code : | DATA STRUCTURES AND ALGORITHMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

Basic Knowledge on C Programming.

**OBJECTIVES**

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

**COURSE OUTCOME**

1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
2. For a given Search problem (Linear Search and Binary Search) student will able to implement it.
3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
4. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.
5. Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

**Mapping with Program Outcome**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | | | | | | | M | | |
| CO2 | | S | | | | S | | M | | | | |
| CO3 | | S | | S | | S | | M | L | | | |
| CO4 | | M | | S | | S | | S | L | | | |
| CO5 | | L | | S | | S | M | | M | | | |

S -STRONG, M- MEDIUM, L- LOW

**UNIT - I**

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.

**UNIT - II**

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

**UNIT - III**

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

**UNIT - IV**

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

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

**UNIT - V**

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

**TEXT BOOKS**

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

**REFERENCE BOOKS**

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

| Course Code : | OBJECT ORIENTED PROGRAMMING USING C++ | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

Basic Knowledge in C Programming

**OBJECTIVES**

The course will introduce standard tools and techniques for software development, using object oriented approach, use of a version control system, an automated build process, and an appropriate framework for automated unit.

1. To understand the concept of OOP as well as the purpose and usage principles of Inheritance, polymorphism, encapsulation and method overloading
2. To identify classes, objects, members of a class and the relationships among them needed for a specific problem.

**COURSE OUTCOMES**:

After completing the Course, students will learn:

1. Articulate the principles of object-oriented simple abstract data types, control flow and design implementations, using abstraction functions to document them.
2. Outline the essential features of object-oriented programming such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity using class and object.
3. Apply the object using constructors and destructors and using the concept of polymorphism to implement compile time polymorphism in programs by using overloading methods and operators.
4. Use the concept of inheritance to reduce the length of code and evaluate the usefulness.
5. Apply the concept of run time polymorphism by using virtual functions, overriding functions and abstract class in programs.
6. Use I/O operations and file streams in programs and by applying the concepts of class and objects using Generic types , error handling and STL
7. Analyze problems and implement simple C++ applications using an object-oriented programming approach.
8. Name and apply some common object-oriented design patterns and give examples of their use.

**CO and PO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | | | | | | | | | | |
| CO2 | L | M | | S | | | | | | | | M |
| CO3 | | M | S | | | | | | | | | |
| CO4 | | | M | S | | | | | | | S | |
| CO5 | | | | M | S | | | | | | | |
| CO6 | | | | | | M | | | | | | |
| CO7 | | | S | | | | L | M | | S | M | |
| CO8 | L | | | | | | | | | S | | M |

S - STRONG, M- MEDIUM, L – LOW

**UNIT- I**

Introduction to object oriented programming, Concepts of object oriented programming. C++ programming basics- Data types, Manipulators, Cin, Cout, Type conversion, arithmetic operators, Loops and decisions. Class and objects : Basics of class and objects, access specifiers , member functions defined inside and outside the class.

**UNIT- II**

Constructors and its types, destructors, objects as function arguments, Returning objects from Functions, inline functions, static data and member function. Arrays: Defining & accessing Array elements, arrays as class member data, array of Objects.

**UNIT - III**

Friend functions Friend Classes. Operator Overloading: Overloading Unary Operators, Operator Arguments, Return Values, Overloading Binary Operators – Arithmetic operators, Concatenating Strings, Multiple overloading Comparison operators, Arithmetic Assignment Operators , Overloading the assignment operator.

**UNIT- IV**

Inheritance-Derived class and base class, Types of inheritance, derived class constructors, overriding member functions, Public and private inheritance, Class Hierarchies. Memory management -new and delete operator, string class using new. Pointers -Pointers to Objects Referring to Members, Array of pointers to objects.

**UNIT- V**

Virtual Functions, Pure virtual functions, Late Binding, Abstract Classes, Abstract base class , Virtual base classes, the this pointer. Templates - function templates, class template. File Handling-Introduction to graphics. Generic types and collections –Namespace, error handling , exception handling, signal handling and STL.

**TEXT BOOKS**

1. Object Oriented Programming in Microsoft C++ - Robert Lafore,Galgotia Publication Pvt Ltd.
2. The Compete Reference C++, Herbert Schlitz, TMH

**REFERENCE BOOKS**

1. Let us C++ - Yaswant Kanitkar( for templates) ,BPB Publication
2. C++ and Object Oriented Programming Paradigm, PHI
3. C++ : How to Program, 9th Edition, Deitel and Deitel, PHI
4. Object Oriented Programming in C++ - E. Balaguruswamy, Tata Mcgraw Hill.
5. Teach yourself C++ - Herbertsehildt, OSBORNE/MH

| Course Code : | INTERNET OF THINGS: ARCHITECTURE PROTOCOLS AND APPLICATIONS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Aim:** The purpose of this course is to impart knowledge on IoT Architecture and various protocols, study their implementations.

**Pre-requisites:** Nil

**Course Objectives:**

1. To Understand the Architectural Overview of IoT
2. To Understand the IoT Reference Architecture and RealWorld Design Constraints
3. To Understand the various IoT Protocols (Datalink, Network, Transport, Session, Service)

**UNIT- I OVERVIEW**

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management

**UNIT – II REFERENCE ARCHITECTURE**

IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

**UNIT- III IOT DATA LINK LAYER & NETWORK LAYER PROTOCOLS**

PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP.

**UNIT- IV TRANSPORT & SESSION LAYER PROTOCOLS**

Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer HTTP, CoAP, XMPP, AMQP, MQTT

**UNIT- V SERVICE LAYER PROTOCOLS & SECURITY**

Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4 , 6LoWPAN, RPL, Application Layer

**REFERENCES:**

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014.
2. Peter Waher, “Learning Internet of Things”, PACKT publishing, BIRMINGHAM – MUMBAI
3. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
4. Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118-47347-4, Willy Publications
5. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on Approach)”, 1 st Edition, VPT, 2014.
6. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

| Course Code : | DIGITAL ELECTRONICS LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 2 |

**PRE-REQUISITE**

Comfortable programming in Basic Electronics

**OBJECTIVES**

1. Understand the Diode operation and switching characteristics.
2. Understand the Operation of BJT, FET, MOSFET metal semiconductor rectifying and ohmic contacts,
3. Study various number systems and to simplify the mathematical expressions using Boolean functions - simple problems.
4. Study implementation of combinational circuits.

**OUTCOME**

After successfully completing this course a student will

1. Develop basic knowledge on the behavior and the characteristics of semiconductor junction,
2. Acquire knowledge on the applications of BJT, FET, MOSFET.
3. Understand the basic number system and Boolean algebra.
4. Understand the basics of combinational & sequential circuits.

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L | | | M | | | | | L | M |
| CO2 | L | | | H | | | L | M | L | |
| CO3 | M | | | H | | | M | | M | |
| CO4 | H | H | M | M | | | | L | M | M |

S -STRONG, M- MEDIUM, L- LOW

**LIST OF EXPERIMENTS**

1. Implementation of Boolean functions, Adder / Subtractor Circuits.
2. Implementation of Multiplexer/ Demultiplexer Circuits.
3. Implementation of Code converters (Gray to Binary, Binary to Gray, Excess-3 to BCD and BCD to Excess-3).
4. Study of flip-flops - JK, RS, D &T FF.
5. Shift registers – SISO, PIPO, PISO and SIPO.
6. V-I characteristics of PN & Zener diode.
7. Characteristics BJT (CE mode)
8. Characteristics of JFET
9. Characteristics of SCR
10. Characteristics of UJT

| Course Code : | DATA STRUCTURES AND ALGORITHMS LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 2 |

**PRE-REQUISITE**

Basic Knowledge on C Programming.

**OBJECTIVES**

The students will be trained to:

1. Be familiar with c programming.
2. Learn to implement Linear and Nonlinear data structures.
3. Learn to implement sorting and searching algorithms.

**OUTCOME**

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

1. Design and implement C programs for implementing stacks, queues, linked lists.
2. Apply good programming design methods for program development.
3. Apply the different data structures for implementing solutions to practical problems.
4. Develop searching and sorting programs.

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | S | S | | S | | | | L | M | | |
| CO2 | | S | | | S | S | | M | | M | | |
| CO3 | S | S | | | | S | S | M | L | | M | |
| CO4 | | | | S | | S | | S | L | | | |

S -STRONG, M- MEDIUM, L- LOW

**LIST OF PROGRAMS**

1. Implement linear and Binary Search algorithms
2. Implementation of Stack
3. Implement application of Stack
4. Implementation of Queue
5. Implementation of Singly Linked List.
6. Implementation of Doubly linked list.
7. Perform Traversals on a Binary Tree.
8. Implement Graph Search algorithms.
9. Sort the Given Numbers using.
    a. Selection Sort.
    b. Heap Sort.
    c. Quick Sort.
    d. Merge Sort.
10. Implement Hashing

| Course Code : | OBJECT ORIENTED PROGRAMMING USING C++ LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 2 |

**PRE-REQUISITE**

Basic Knowledge on C Programming

**OBJECTIVES**

The students will be trained to:

1. Be familiar with c programming
2. Learn to implement the concepts of object oriented programming.
3. Learn to implement advanced features of C++.

**COURSE OUTCOME**

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

1. Design , implement C++ programs and Understand the features of C++ supportingobject oriented programming
2. Understand the relative merits of C++ as an object oriented programming language
3. Understand how to apply the major object-oriented concepts to implement object , friend function , constructor , overloading .
4. Creating object based programs in C++, encapsulation, inheritance and polymorphism
5. Understand advanced features of C++ specifically stream I/O, templates and operator overloading
6. Understand how to produce object-oriented software using C++ with file handling , error and signal handling.
7. Understand how to produce object-oriented software using C++ with eneric types , STL , web based C++ and graphics.

**CO and PO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | S | | | | | M | | | | |
| CO2 | | M | S | | | L | | S | M | S | | |
| CO3 | | | M | S | | L | S | | S | | M | |
| CO4 | | S | | M | S | | | | | | L | S |
| CO5 | S | | | L | | M | | | M | | S | |

S - STRONG, M- MEDIUM, L – LOW

## LIST OF PROGRAMS

1. Illustrate class & objects. Implement member function defined inside and outside the class.
2. To demonstrate the concept of function overloading applied to the member functions.
3. Implement passing object as function arguments and return object from function
4. To demonstrate the use of constructor with its types and destructor
5. Illustrate the use of static data member and static member function
6. Illustrate the use of array of objects
7. Illustrate the memory management operator
8. Illustrate the use of friend class and friend function
9. To Implement the use of unary operator overloading
10. To implement the use of Binary operator overloading
11. To implement the assignment and comparison of two strings using binary operator overloading
12. To implement the use of single private and public inheritance
13. To implement the use of multiple inheritance
14. To implement the use of multilevel inheritance
15. To demonstrate the use of this pointer & inline function
16. To implement the Pure Virtual Function
17. To implement the use of class template
18. To implement the use of function template
19. To implement File handling
20. Program to implement exception handling in C++
21. Program to implement user defined namespace in C++
22. Program to implement signal (interrupts) handling in C++
23. Simple programs using C++ STL
24. Web Programming with C++
25. Simple programs using graphics concepts in C++

| Course Code : | PYTHON PROGRAMMING LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 2 |

**PRE-REQUISITE**

Knowledge in basics of any Programming language

**OBJECTIVES**

- To write, test, and debug simple Python programs.
- Read and write data from/to files in Python.
- Represent compound data using Python lists, tuples, dictionaries.
- Use functions for structuring Python programs.
- To implement Python programs with conditionals and loops.

**OUTCOMES**

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

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

**Mapping with Programme outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | S | | | | | | | | | |
| CO2 | | | S | | | | | | | | | |
| CO3 | | | | M | | | | | | | | |
| CO4 | | | | M | | | | | | | | |
| CO5 | | | | M | | | | | | | | |

S -STRONG, M- MEDIUM, L- LOW

**LIST OF PROGRAMS**

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton‘s method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

**PLATFORM NEEDED**

Python 3 interpreter for Windows/Linux

# SEMESTER -IV

| Course Code : | DISCRETE MATHEMATICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 1 | 0 | 4 |

**COURSE OUTCOMES**

For a given logic sentence express it in terms of predicates, quantifiers, and logical connectives. For a given a problem, derive the solution using deductive logic and prove the solution based on logical inference and classify its algebraic structure. Students can evaluate Boolean functions, simplify expressions using the properties of Boolean algebra and develop the given problem as graph networks and solve with techniques of graph theory.

**COURSE OBJECTIVES:**

- To familiarize with sets and relations.
- To learn counting techniques
- To familiarize with logic
- To familiarize with algebraic structures and Boolean algebra
- To understand graph networks and its applications

After the successful completion of the course students will be able to

| COS NO. | Course Outcomes | Bloom's level |
|---|---|---|
| CO1 | express a given logical sentence in terms of predicates, quantifiers, and logical connectives. | Understanding and Applying |
| CO2 | derive the solution for a given a problem using deductive logic and prove the solution based on logical inference and classify its algebraic structure. | Understanding and Applying |
| CO3 | evaluate Boolean functions, simplify expressions using the properties of Boolean algebra | Understanding and Applying |
| CO4 | develop the given problem as graph networks and solve with techniques of graph theory. | Understanding and Applying |

**Mapping of Course Outcome to Program Outcomes:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | S | L | M | S | L | M | M | L | S |
| CO2 | S | S | S | S | S | M | L | L | M | M | S | S |
| CO3 | S | S | M | M | S | M | L | L | M | M | L | S |
| CO4 | S | S | M | M | S | M | L | L | M | M | L | S |

**UNIT - I SETS, RELATION AND FUNCTION**

Finite and infinite Sets, Countable and uncountable Sets, Size of a Set, Set operations, Ordered pairs and Cartesian Products, Relations, Types of Relations, Some operations on relations, Properties of relations, Equivalence classes, Partition of a set, Matrix representation of a relation, Representaion of relations by graphs, Hasse diagrams for Partial Ordering Relation.

Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm.

**UNIT - II COUNTING TECHNIQUES**

Basic counting techniques-Inclusion and Exclusion, Pigeon-hole principle, Permutation and Combination.

**UNIT – III PROPOSITIONAL LOGIC**

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

**UNIT – IV ALGEBRAIC STRUCTURES AND MORPHISM**

Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form.

**UNIT - V GRAPHS AND TREES**

Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Coloring, Coloring maps and Planar Graphs, Coloring Vertices, Coloring Edges, List Coloring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Shortest distances by Prim's and Kruskal's algorithm..

**SUGGESTED BOOKS**

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill
2. Susanna S. Epp, Discrete Mathematics with Applications,4th edition, Wadsworth Publishing Co. Inc.
3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer OrientedApproach, 3rd Edition by, Tata McGraw – Hill.
4. J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and It's Application toComputer Science", TMG Edition, TataMcgraw-Hill
5. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press.
6. Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson,
7. Veerarajan, Discrete Mathematics, Tata McGraw – Hill.

| Course Code : | COMPUTER ORGANIZATION AND ARCHITECTURE | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

Computer Science or equivalent course.

**OBJECTIVES**

1. To have a thorough understanding of the basic structure and operation of a digital computer.
2. To discuss in detail the Arithmetic and Logical operations, fixed and floating point operations including the algorithms & implementation.
3. To study in detail the different types of controls and the concept of pipelining.
4. To study in detail the different types of Bus, Memory systems and I/O systems.
5. To learn and understand how the system is interconnected with processors, memory, and other peripherals devices parallel and how it will communicate
6. To understand and design the concept of Pipeline process
7. To study in detail the different types of processor and parallel processor model and its architectures.

**COURSE OUTCOME**

1. An ability to design the arithmetic and logical unit.
2. An ability to implement different types of control and the concept of I/O and pipelining Techniques.
3. An ability to select appropriate computer systems for given application domains for future design of computer architecture.
4. Understand and develop processor for future computing hardwires to solves the problems of high end computing applications
5. Imparting training to the students to able to design new computer architecture of their own so that it could be solve the computer stakeholder problems in future.
6. An ability to understand and design the various parallel processor model and architecture for design of futures processor models

**CO and PO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | | | S | | | | | | |
| CO2 | L | | M | S | | | | | | |
| CO3 | | | S | | | | | | | |
| CO4 | | M | | | L | | | S | | |
| CO5 | | | | m | | | | | L | |
| CO6 | M | | | | | | | | | |

S - STRONG, M - MEDIUM, L - LOW

**UNIT - I BASIC STRUCTURE OF COMPUTER & INSTRUCTIONS**

Functional components and operations of general computer system, Interconnection of components, Computer Evolution and Performance, Representation of Instructions- Machine instructions, Operands, Addressing modes, Instruction cycles, Instruction formats, Instruction sets, Instruction set architectures - CISC and RISC architectures.

**UNIT - II BASIC PROCESSING UNITS**

Number Systems and conversions, Integer Arithmetic operations, Fixed and Floating point representation and operations, Organization of a processor - Single and Multiple bus organization, Processing units elements, Control unit, Data path in a CPU, Organization and operations of a control unit, Hardwired and Micro programmed control unit.

**UNIT - III MEMORY AND I/O SYSTEM ORGANIZATION**

Classification of memory - Internal Organization of a memory chip, Cache memories– Virtual memory – Storage and Memory management requirements, Accessing I/O devices – Programmed Input/output –Interrupts – Direct Memory Access – Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, USB).

**UNIT - IV PIPELINING**

Basic concepts – Single-Cycle versus Pipelined Performance- Pipeline Hazards- Data hazards- forwarding vs. stalling, Control hazards–Pipeline Data path and control – Branch prediction- Performance considerations.

**UNIT – V PARALLEL AND SUPER SCALAR PROCESSOR**

Introduction to parallel processors -Parallel computer models- multiprocessors and multi computer – Multi vector and SIMD computer- conditions of parallelism - System interconnect architectures performance- Concurrent access to memory and cache coherency - Superscalar Processors.

**TEXT BOOKS**

1. V. Carl, G. Zvonko and S. G. Zaky, **"**Computer organization**"**, McGraw Hill, 1978.
2. J. L. Hennessy and D. A. Patterson, **"**Computer Architecture - A Quantitative Approach**"**, Morgan Kauffman, 2011.
3. Kai Hwang, "Advanced Computer Architecture, Parallelism, Scalability, Programmability", McGraw Hill, 1993.

**REFERENCE BOOKS**

1. W. Stallings, "Computer organization", PHI, 1987.
2. P. Barry and P. Crowley, "Modern Embedded Computing", Morgan Kaufmann, 2012.
3. N. Mathivanan, "Microprocessors, PC Hardware and Interfacing", Prentice Hall, 2004.
4. Y. C. Lieu and G. A. Gibson, "Microcomputer Systems: The 8086/8088 Family", Prentice Hall India, 1986.

5. J. Uffenbeck, “The 8086/8088 Design, Programming, Interfacing”, Prentice Hall, 1987.
6. B. Govindarajalu, “IBM PC and Clones”, Tata McGraw Hill, 1991.
7. B. Brey and C. R. Sarma, “The Intel microprocessors”, Pearson Education, 2000.
8. P. Able, “8086 Assembly Language Programming”, Prentice Hall India.
9. Kai Hwang , Faye A. Briggs, “Computer Architecture and Parallel Processing”, McGraw-Hill series, 1985

| Course Code : | MICROPROCESSOR AND MICROCONTROLLER | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

Basic knowledge in Digital Electronics

**OBJECTIVES**

The objective of the course is to impart knowledge on:

1. The architecture of 8085, 8086, ARM and 8051
2. The addressing modes & instruction set of 8085,8086, ARM and 8051
3. The need and use of Interrupt structure
4. Simple programs and commonly used peripheral/interfacing ICs.

**COURSE OUTCOME**

After completion of the course the students are expected to be able to:

1. Understand block diagram, interrupt structure of 8086 and other processor configurations
2. Interface ICs like 8255 PPI, 8279 Display and Keyboard Interface, Programmable Interrupt controller and DAM Controller
3. Develop simple programs with Basic Arithmetic Functions, String functions and Array
4. Understand block diagram of 8051, Memory organization, counters and interrupt structure in 8051
5. Develop simple programs in Arithmetic Function, Interfacing with motor and display devices
6. Understand the block diagram and fundamentals of ARM processor, Thumb Instruction set.

**CO & PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | H | H | M | | | | | M | | M |
| CO2 | M | H | M | H | | | L | | | |
| CO3 | | | | H | M | | | | | |
| CO4 | H | H | M | | | | M | M | M | |
| CO5 | | | H | M | M | | L | L | | M |
| CO6 | M | H | H | | | | | H | H | M |

S -STRONG, M- MEDIUM, L- LOW

**UNIT - I INTRODUCTION TO MICROPROCESSOR**

Introduction to 8086 Microprocessor, Architecture, Addressing Modes, Instruction Set, Interrupts and Simple programs: String Operations, Manipulations, Sorting of Array. Numeric Data Processor 8087 and I/O Processors 8089- Architecture

**UNIT - II CONFIGURATION AND INTERFACING WITH MICROPROCESSOR**

Coprocessor Configuration-Loosely Coupled, Closely Coupled.
8255 – Programmable Peripheral Interface, Pin details, Architecture, Modes of operation.
8279 – Display and Keyboard Interface
Programmable Interrupt Controller, DMA Controller, Memory Mapped, I/O Mapped

**UNIT – III INTRODUCTION TO MICROCONTROLLER 8051**

Features of Microcontroller, Internal Block Diagram of 8051, Memory organization, Timer and Counters, I/O ports, Interrupt Structure

**UNIT - IV PROGRAMMING IN MICROCONTROLLER 8051**

Addressing modes of 8051, Instruction set of 8051, Counter and Timer Programming in 8051, Serial Communication, Interrupt Programming, Keyboard and Display devices interfacing, Sensor Interfacing, Stepper motor

**UNIT – V ADVANCED PROCESSORS**

ARM Processor Fundamentals, ARM Instruction Set, THUMB Instruction Set, Exception and Interrupt Handling, Writing and Optimizing ARM Assembly Code.
Pentium Processor Architecture and Functional Description, RISC Processor, Risc Addressing Modes

**TEXT BOOKS**

1. Mathur S, " Microprocessor 8086: Architecture, Programming and Interfacing", Fourth Edition, 2004
2. Krishna Kant, " Microprocessors and Microcontrollers Architecture, Programming and System Design 8085,8086, 8051, 8096", Third Edition, 1998
3. Barry B. Brey, "The Intel Microprocessors, Architecture, Programming and Interfacing", Eighth Edition, 2000
4. Muhammad Ali Mazidi and Janice GillispieMazidi, "The 8051 Microcontroller and Embedded Systems using Assembly and C", Second Edition, 1998
5. Kenneth J. Ayala, "The 8051 Microcontroller Architecture, Programming and Applications", Third Edition, 2000
6. Andrew Sloss, Dominic Symes and Chris Wright, "ARM System Developer's Guide, Designing and Optimizing System Software", First Edition, 2000

**REFERENCES**

1. K. Bhurchandi and A.K.Ray, "Advanced Microprocessor and Peripherals", 3rd Edition, 2013
2. Ajit Pal, "Microcontrollers: Principles and Applications", 2011
3. I.Scott Mackenzie and Raphel C.W. Phan, "The 8051 Microcontroller", 4th Edition, 2002
4. Patrick Stakem, "The architecture and applications of the ARM Microprocessors", 2002
5. William Hohl, "ARM Assembly Language: Fundamentals and Techniques", Second Edition, 2003

| Course Code : | DESIGN AND ANALYSIS OF ALGORITHMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

Basic knowledge of Computer Programming.

**OBJECTIVES**

1. Analyze the asymptotic performance of algorithms.
2. Write rigorous correctness proofs for algorithms.
3. Demonstrate a familiarity with major algorithms and data structures.
4. Apply important algorithmic design paradigms and methods of analysis.
5. Synthesize efficient algorithms in common engineering design situations

**OUTCOME**

After completion of the course the students are expected to be able to:

1. For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms .
2. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
3. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.
4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity.
5. For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.
6. Explain the ways to analyze randomized algorithms (expected running time, probability of error).
7. Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS).

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | | | | L | | | M | | |
| CO2 | | S | | | | S | | M | | | | |
| CO3 | | S | | S | | S | | M | L | | | |
| CO4 | | M | | S | | S | | S | L | | | |
| CO5 | | S | | S | | S | M | | M | | | |
| CO6 | | S | S | | | | | | | | M | |
| CO7 | S | S | | | L | | | | M | L | | |

S -STRONG, M- MEDIUM, L- LOW

**UNIT - I**

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

**UNIT - II**

Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch and Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving , Bin Packing, Knap Sack and TSP. Heuristics – characteristics and their application domains.

**UNIT - III**

Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

**UNIT - IV**

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.

**UNIT - V**

Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE

**TEXT BOOKS:**

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.

**REFERENCE BOOKS:**

1. AlgorithmDesign,1ST Edition, Jon Kleinberg and Éva Tardos, Pearson.
2. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
3. Algorithms—A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA.

| Course Code : | PRINCIPLES OF MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

Nil

**OBJECTIVES**

1. Apply managerial functions, as well as theory and principles of planning, organizing, leading, and controlling resources to accomplish organizational goals.
2. Special emphasis will be placed on skills necessary for a manager to be effective.
3. The subject will involve an overview approach to covering the various concepts required for an overall understanding of management's role in the contemporary organization.
4. Apply Economic concepts, as well as theory and principles of Understand economic factor
5. Contribute to society by behaving ethically and technical responsibilities to take correct decision making

**COURSE OUTCOMES**

After completion of the course the students are expected to be able to:

1. Know, comprehend, apply, analyze, synthesize and evaluate the basic principles of the fundamentals of managing organizations and Economic concepts.
2. Identify and apply appropriate management techniques for managing contemporary organizations
3. Understand the concepts of time value of money and cost analysis.
4. Understand the skills, abilities, and tools needed to obtain a job on a management track in an organization of their choice.
5. Complete specific activities, as identified in the syllabus, related to managerial functions and economic concepts. At the close of the semester, students will be prepared for further study in the area of management.

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | H | | | | | | | | | | | |
| CO2 | | H | | | | | | | | | M | |
| CO3 | | | M | M | | | | | | | | |
| CO4 | | | | | H | | | | | L | | M |
| CO5 | | | | M | | | | M | | | | |

H- HIGH, M- MEDIUM, L- LOW

**UNIT – I**

Nature of management and its process – Contribution of Taylor and Fayol to management – Functions and principles of management –Industrial ownership – Types, formation, merits and demerits – Management by objective , Management by exception.

**UNIT – II**

Planning – Nature & purpose, Kinds of plans – Decision making process and kinds of decision –Organization process – organization structure, Staffing - Selection and Recruitment – Career Development - Career stages – Training - Performance Appraisal.

**UNIT – III**

Direction and Control: Motivation process and theory – Leadership – Leadership style. Communication – process and methods – barriers, coordination – features and Techniques, Control process and methods.

**UNIT – IV**

Basic economic concept – Importance of economic in engineering – Economic and technical decisions – Demand and supply – Factors influencing demand – Elasticity of demand – demand forecasting – Competition.

**UNIT – V**

Actual cost and opportunity cost – Marginal cost – Incremental cost and sunk cost, Fixed and variable cost – Short-run long-run cost – Cost output relationship – Price fixation – Pricing policies – Pricing methods. Break even analysis.

**TEXT BOOKS**

1. L.M..Prasad Principles & Practice of Management,7th Edition, Sultan Chand & Sons, 2007
2. Varshney and Maheswari, Managerial Economics, Third Edition, Sultan Chand & Sons, 2011

**REFERENCE BOOKS**

1. Harold Knoontz, Heinz Weihrich – Essentials of Management,First Reprint, Tata Mcgraw Hill,2010.
2. Engineering Economics and Costing by Mishra Sasmita, Second Edition, PHI Learning Pvt. Ltd.,,2010.

| Course Code : | SANSKRIT AND INDIAN CULTURE – I | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 |

**UNIT - I**

1. Meaning and definition, Significance of Sanskrit language
2. Relations between Sanskrit and other languages

**UNIT - II**

1. Introduction to Vedic literature, Origin of Vedas, Classification of Vedas
2. Structure of Vedas (Samhitā, Brāhmaṇā, Āranyaka)
3. Introduction to Upaniṣads and its relavance

**UNIT - III**

1. Introduction to Upavedas and their classification & its significance
2. Introduction to Āyurveda,
3. Application of Āyurveda in present days

**UNIT - IV**

1. Introduction to Dhanurveda - the Indian Martial Art, History of Dhanurveda, Dhanurveda and its impacts in the regional styles
2. Introduction to Gāndarvaveda
3. Text on dramaturgy and music

**UNIT - V**

1. Introduction to Arthaśāstra - the Indian statecraft, economic policy and military strategy
2. Relevance of Arthaśāstra to the present days
3. Message of Paramacharya

**REFERENCE TEXTS**

1. A text book of elementary Linguistics and Phonetics by Dr. R. Ravi S Sharma, New Delhi 2012
2. A history of Sanskrit literature by A. B. Keith New Delhi 1993
3. A history of Indian literature by Maurice Winternitz New Delhi 1990
4. Samskruta Sahitya Ka Itihas - by Baladev Upadyaya
5. short history of Sanskrit Literature by T.K. Balachandra Iyer, Palaghat 1998

| Course Code : | EMBEDDED SYSTEMS AND PROGRAMS USING PYTHON LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 5 |

Following are some of the programs that a student should be able to write and test on an Raspberry Pi, but not limited to this only.

1. Start Raspberry Pi and try various Linix commands in command terminal window: *ls, cd, touch, mv, rm, man, mkdir, rmdir, tar, gzip, cat, more, less, ps, sudo, cron, chown, chgrp, ping* etc.
2. Run some python programs on Pi like:
    a. Read your name and print
    b. Hello message with name
    c. Read two numbers and print their sum, difference, product and division.
    d. Word and character count of a given string
    e. Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input
    f. Print a name 'n' times, where name and n are read from standard input, using for and while loops. Handle Divided by Zero Exception.
    g. Print current time for 10 times with an interval of 10 seconds.
    h. Read a file line by line and print the word count of each line.
3. Light an LED through Python program
4. Get input from two switches and switch on corresponding LEDs
5. Flash an LED at a given on time and off time cycle, where the two times are taken from a file.
6. Flash an LED based on cron output (acts as an alarm)
7. Switch on a relay at a given time using cron, where the relay's contact terminals are connected to a load.
8. Get the status of a bulb at a remote place (on the LAN) through web.
   The student should have hands on experience in using various sensors like temperature, humidity, smoke, light, etc. and should be able to use control web camera, network, and relays connected to the Pi

| Course Code : | COMPUTER ARCHITECTURE LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 2 |

**PRE-REQUISITE**

Programming Knowledge in C.

**OBJECTIVES**

It is aimed to teach the following

1. Understand various components of PC.
2. Study and design various Logic Gates.
3. Design Multiplexer/Demultiplexer, Encoder/Decoder, Synchronous/Asynchronous Counter.
4. Design Shift registers, Code Converters, BCD adder and Comparator.
5. Design of Simple ALU operations.

**COURSE OUTCOME**

After successfully completing this course a student will be able to

1. Understand various hardware components on the computer system and Dismantling and assembling of PC.
2. Implement Logical Gates.
3. Implement Multiplexer/Demultiplexer, Encoder/Decoder, Synchronous /Asynchronous Counter.
4. Implement Shift register – Right/ Left/Serial/Parallel.
5. Implement Shift registers, code converters, BCD adder and comparator.
6. Implement ALU for both Integer and Floating point numbers.

**CO and PO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | S | L | M | | | | |
| CO2 | | S | M | L | | | | | | |
| CO3 | L | | S | M | | | | | | |
| CO4 | S | | L | M | | | | | | |
| CO5 | | L | M | | | | | | | |
| CO6 | L | M | S | | | | | | | |

S -STRONG, M- MEDIUM, L- LOW

**SOFTWARE REQUIRED**

Synthesis tool: Xilinx ISE.

Simulation tool: ModelSim Simulator (with support Verilog code).

**LIST OF EXPERIMENTS**

1. Recognize various components of PC.
2. Dismantling and assembling of PC.
3. To Simulate AND, OR, NOT, NAND, NOR Gates.
4. To Simulate Encoder/Decoder.
5. To Simulate Asynchronous Counter/ Synchronous counter (UP / Down / UP Down).
   a. To Design and simulate shift registers – Right / Left /Serial /Parallel (SISO, SIPO, PIPO, PISO).
6. To design and Simulate BCD Adders.
7. To design and Simulate Comparators.
8. To design and simulate Memory for Write and Read instruction.
9. To design and simulate ALU unit for Booth Multiplication Algorithm.
10. To design and simulate ALU unit for Division algorithm.

**BOOK REFERENCE**

"Verilog HDL: A guide to Digital Design and Synthesis" - Samir Palnitkar , SunSoft Press 1996.

**WEB REFERENCES**

1. http://download.xilinx.com/direct/ise9_tutorials/ise9tut.pdf
2. http://web.stanford.edu/class/ee183/handouts_win2003/Modelsim_short_tutorial.pdf
3. http://bertrand.granado.free.fr/Sysprog/SysProg/Cours_files/modelsim_tut.pdf

| Course Code : | MICROPROCESSOR AND MICROCONTROLLER LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 2 |

**PRE-REQUISITE**

Basic knowledge of Digital Electronics, Computer Orgnization, Microprocessors and Microcontrollers

**OBJECTIVES**

1. The Architecture of 8086 & 8051 and ARM.
2. The addressing modes & instruction set of 8086 & 8051.
3. The need & use of Interrupt structure.
4. Simple programing Skills.
5. Commonly used peripheral / interfacing ICs.

**COURSE OUTCOME**

After completion of the course the students are expected to be able to:

1. Understand the functional block diagram, Timing Diagram, Interrupt structure and Multiprocessor configurations of 8086Microprocessor.
2. Develop the Programming skills using Loop structure with counting & Indexing, Look up table, Subroutine instructions stack.
3. Interface ICs 8255 PPI, 8259 PIC, 8257 DMA, 8251 USART, 8279 Key board display controller and 8253 Timer/ Counter, A/D and D/A converter.
4. Comprehend the Functional block diagram ,Instruction format and addressing modes, Interrupt structure ,I/O Ports and Serial communication of 8051 Microcontroller.
5. Develop the programming skills in square, triangular and sine wave form generation and stepper motor control.

**CO & PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | | | | M | | | | | |
| CO2 | H | M | M | H | M | | H | H | | H |
| CO3 | | H | M | | | | M | | M | |
| CO4 | H | M | | M | | | | H | | M |
| CO5 | M | H | | L | L | | | | L | |

H-High,M-Medium,L-Low

## LIST OF EXPERIMENTS

**EXPERIMENTS IN MICRPROCESSOR 8086:**

1. Write a ALP to perform basic arithmetic operation in various addressing modes on two 16 bit Numbers.
2. Write a ALP to determine sum of elements in an array.
3. Write a ALP to search for a given number, Smallest and Largest Number in an array
4. Write a ALP to Sort the given array (Ascending and Descending)
5. Write a ALP to study the BSR and I/O modes of 8255with 8086 microprocessor.
6. Generation of Square, Triangular and Saw tooth waveform using DAC interfaced with 8086 microprocessor.
7. Write a ALP to control the speed and direction of Stepper motor.

**EXPERIMENTS IN MICROCONTROLLER 8051:**

1. Write a microcontroller program to perform basic arithmetic operation on two 8 bit numbers.
2. Write a ALP to study the various modes of 8255 with Microcontroller.
3. Write a ALP to generate square and Sawtooth waveform using DAC interfaced with 8086 microprocessor
4. Write a ALP to interface Seven Segment Display.
5. Write a ALP to interface 16 x 2 LCD Display with Microcontroller 8051 using Keil µVision

**EXPERIMENTS IN ARM PROCESSOR:**

1. Study of ARM evaluation system.
2. Study and analyze the Interfacing DAC and Interfacing LCD
3. Study and analyze the Interfacing Stepper motor and Temperature Sensor.

| Course Code : | DESIGN AND ANALYSIS OF ALGORITHMS LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 2 |

**PRE-REQUISITE**

Basic knowledge of Computer Programming.

**OBJECTIVES**

1. To implement various problems related to different algorithmic techniques
2. To study the space and time complexity of the implemented algorithms

**COURSE OUTCOME**

After completion of the course the students are expected to be able to:

1. Implement various algorithms and gain the knowledge of problem solving
2. Learn the different techniques used in development of algorithm with examples

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | | S | | | | L | M | | |
| CO2 | | S | S | | S | S | | L | | M | L | |

S -STRONG, M- MEDIUM, L- LOW

**LIST OF PROGRAMS**

1. Implement Tower of Hanoi.
2. Implement nth Fibonacci term using recursion & iteration.
3. Implement Bin Packing
4. Implement Fractional Knapsack using greedy method
5. Implement Travelling Salesman Problem
6. Implement Minimum Spanning Tree
7. Implement Shortest path algorithm
8. Implement Network Flow algorithm
9. Implement Approximation algorithms
10. Implement Randomized algorithm

| Course Code : | IT WORKSHOP (Scientific Lab) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 2 |

**PRE-REQUISITE**

Basic Knowledge any Programming Language

**OBJECTIVES**

1. To know the fundamental concepts of Matrix Operations with real World data.
2. To explore various graphs and perform analysis by various Chart operations.
3. To extract useful information from complex datasets.
4. To know about the research that requires the integration of large amounts of data.

**COURSE OUTCOMES**

1. Apply the basic programming concepts for basic arithmetic operations
2. Implement graphs for Mathematical expressions
3. Apply Research techniques for plotting graphs
4. Perform file handling operations.

**CO and PO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | | | | | | | | | | | M |
| CO2 | | | | | | H | | | | | M | |
| CO3 | | | | M | | | | H | | | | |
| CO4 | | | M | | | | | | | | | |

S - STRONG, M- MEDIUM, L – LOW

**LIST OF PROGRAMS**

1. Introduction to SCI Lab, Installation and benefits.
2. Basic Commands in SCI Lab.
3. Vector Operations.
4. Matrix Operations.
5. Conditional Branching.
6. Iteration
7. Scripts and Functions
8. Plotting 2D Graphs
9. User Defined Input and Output
10. File Handling
11. Integration

**REFERENCE :**

https://spoken-tutorial.org/tutorial-search/?search_foss=Scilab&search_language= English

# SEMESTER-V

| Course Code : | AUTOMATA THEORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**PRE-REQUISITE**

Basic knowledge of Mathematics, Set theory, Mathematical induction principles.

**OBJECTIVES**

The objective of the course is to impart knowledge on Automata Theory

**COURSE OUTCOMES :**

After completion of the subject the students are expected to be able to

1. Design of digital circuits.
2. Design of Lexical analyzer
3. Designing software for identifying the words, phrases and other patterns in large bodies of text.
4. To write software for processing the natural language.
5. To apply in Artificial Intelligence and knowledge engineering, in game theory and games, computer graphics, linguistics etc.,

| COs Nos | Course Outcomes | Bloom's Level |
|---|---|---|
| CO1 | Design of digital circuits | K1, K2, K5 |
| CO2 | Design of Lexical analyzer | K1, K2, K3 |
| CO3 | Designing software for identifying the words, phrases and other patterns in large bodies of text | K2, K4, K5 |
| CO4 | To write software for processing the natural language | K1, K3, K5 |
| CO5 | To apply in Artificial Intelligence and knowledge engineering, in game theory and games, computer graphics, linguistics etc., | K3, K4, K5 |

**Mapping of Course Outcomes to Program Outcomes:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | | | | | ✓ | | ✓ | | | | ✓ | |
| CO2 | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ |
| CO3 | | ✓ | | ✓ | ✓ | | ✓ | | | ✓ | | |
| CO4 | ✓ | | | | ✓ | ✓ | | ✓ | | ✓ | | ✓ |
| CO5 | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | | ✓ | | |

**UNIT – I FINITE AUTOMATA**

An informal picture of finite automata - Deterministic finite automata – Non-deterministic finite automata – An application: Text search – Finite automata with epsilon transitions

**UNIT- II REGULAR EXPRESSIONS AND LANGUAGES**

Regular expressions – Finite automata and regular expressions – Applications of regular expressions: Regular expressions in UNIX, Lexical analysis, Finding patterns in a text – Algebraic laws for regular expressions

**UNIT – III CONTEXT FREE GRAMMARS AND LANGUAGES**

Context free grammars – Parse trees – Applications of context free grammars: Parsers, The YACC parser generator, Markup languages, XML and document type definitions – Ambiguity in grammars and languages.

**UNIT – IV PUSHDOWN AUTOMATA**

Pushdown automaton – The languages of a Pushdown automaton – Equivalence of Pushdown automaton and Context free grammars – Deterministic pushdown automata.

**UNIT – V INTRODUCTION TO TURING MACHINES**

Problems that computers cannot solve – The Turing machine – Programming techniques for Turing machines – Extensions to the basic Turing machine – Restricted Turing machines – Turing machines and computers

Note: The second edition of the prescribed text book differs drastically in treatment (Application oriented) from the first edition (Theory oriented). Hence the treatment of the second edition is to be followed. Questions are to be set on problem solving and not on the theoretical aspects.

**TEXT BOOK**

1. Hopcroft E.John, Motwani Rajeev, Ullman D. Jeffrey, Introduction to Automata theory, Languages and Computation, Second Edition, Pearson Education 2001

**REFERENCE BOOKS**

1. Anderson, A.James, Automata theory with Modern Applications, Cambridge University Press, 2006
2. Carlos Martín-Vide, Victor Mitrana, Grammars and Automata for String Processing,Taylor & Francis, CRC Press, 2004
3. Linz Peter, An Introduction To Formal Languages And Automata, Jones & Bartlett Publishers, 2011

| Course Code : | OPERATING SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

Basic Knowledge about Processors, Synchronization, Memory Management

**OBJECTIVES**

1. To learn the fundamentals of Operating Systems.
2. To learn the mechanisms of OS to handle processes and threads and their communication
3. To learn the mechanisms involved in memory management in contemporary OS
4. To gain knowledge on operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols.
5. To know the components and management aspects of concurrency management
6. To learn programmatically to implement simple OS mechanisms.

**COURSE OUTCOMES**

Upon successful completion of this course, students are expected to have the ability to:

1. Describe and explain the fundamental components of a computer operating system.
2. Define, restate, discuss, and explain the policies for scheduling, deadlocks, memory management, synchronization, system calls, and file systems.
3. Describe and extrapolate the interactions among the various components of computing systems.
4. Design and construct the following OS components: System calls, Schedulers, Memory management systems, Virtual Memory and Paging systems.

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | H | | | | | | | | | | | |
| CO2 | | H | | | | | | | | | | |
| CO3 | | | M | M | | | | | | | | |
| CO4 | | | | | H | | M | L | | L | L | H |

H- HIGH, M- MEDIUM, L- LOW

**UNIT - I**

Introduction - Mainframe systems – Desktop Systems – Multiprocessor Systems Distributed Systems – Clustered Systems – Real Time Systems – Handheld Systems - Hardware Protection –System Components – Operating System Services – System Calls – System Programs – Process Concept – Process Scheduling – Operations on Processes – Cooperating Processes – Inter-process Communication.

**UNIT - II**

Threads – Overview – Threading issues - CPU Scheduling – Basic Concepts – Scheduling Criteria– Scheduling Algorithms – Multiple-Processor Scheduling – Real Time Scheduling – The Critical Section Problem – Synchronization Hardware– Semaphores – Classic problems of Synchronization – Critical regions – Monitors.

**UNIT - III**

System Model – Deadlock Characterization – Methods for handling Deadlocks-Deadlock Prevention – Deadlock avoidance – Deadlock detection – Recovery from Deadlocks – Storage Management – Swapping – Contiguous Memory allocation – Paging – Segmentation – Segmentation with Paging.

**UNIT - IV**

Virtual Memory – Demand Paging – Process creation – Page Replacement – Allocation of frames– Thrashing - File Concept – Access Methods – Directory Structure – File System Mounting – File Sharing – Protection

**UNIT - V**

File System Structure – File System Implementation – Directory Implementation – Allocation Methods – Free-space Management. Kernel I/O Subsystems - Disk Structure – Disk Scheduling –Disk Management – Swap-Space Management. Case Study: The Linux System, Windows

**TEXT BOOK**

1. Abraham Silberschatz, Peter Baer Galvin and GregGagne, “Operating System Concepts”, 9th Edition, John Wiley & Sons (ASIA) Pvt. Ltd,2013.

**REFERENCE BOOKS**

1. Harvey M. Deitel, “Operating Systems”, 3rd Edition, Pearson Education Pvt. Ltd , 2004
2. Andrew S. Tanenbaum, Herbert Bos ,“Modern Operating Systems”, 4rd Edition , Pearson Education, 2014
3. William Stallings, “Operating Systems internals & design principles”, 9thEdition, Pearson Education India, 2018.
4. Pramod Chandra P. Bhatt – “An Introduction to Operating Systems, Concepts and
5. Practice”, 5th Edition , PHI Learning Pvt. Ltd., 2019
6. UNIX Operating System The Development Tutorial via UNIX Kernel Services
7. Authors: **Liu**, Yukun, **Yue**, Yong, **Guo**, Liwei © 2011 ISBN 978-3-642-20432-6

| Course Code : | PROGRAMMING IN JAVA | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

1. Basic programming skills(c,c++)
2. Basic of Object Oriented Programming and Logical skills

**OBJECTIVES**

1. To understand the concept of OOP as well as the purpose and usage principles of Inheritance, polymorphism, encapsulation and method overloading
2. To identify classes, objects, members of a class and the relationships among them needed for a specific problem
3. To create Java application programs using sound OOP practices (e.g., interfaces and APIs) and proper program structuring (e.g., by using access control identifies, automatic documentation through comments, error exception handling)
4. Design and implement a Collection classes and integration with real time applications
5. To use testing and debugging tools to automatically discover errors of Java programs as well as use versioning tools for collaborative programming/editing.
6. To develop programs using the Java Collection API as well as the Java standard class library.
7. To learn and understand how to connect java with any databases for development of n tier architectures software solutions
8. To Learn and Understand the concept of GUI programming with AWT and SWING concepts

**COURSE OUTCOMES**

5. Use an appropriate concepts OOP as well as the purpose and usage principles of Inheritance, polymorphism, encapsulation and method overloading for developing and Implementing required software to satisfy the customer's needs
6. Apply the concept of class, Objects, Collections classes for creating and using the appropriate software to meet the customers demand
7. Design and Implement the concept of package for API reusability to reduce the software development time and increase the efficiency of delivering software's on time to the customers.
8. Use the file reading and writing concepts to implements various software applications
9. Implement the applications by using java API concepts and testing and debugging tools to automatically discover errors of Java programs as well as use versioning tools for collaborative programming/editing
10. Design and Implementation of Connecting java with Databases to provide the solutions to the customers in N-Tier business software models to maintain the organizational information's effectively

11. Design and Implements the concept of GUI based software applications using appropriate GUI API.

**CO and PO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | | M | | | | | | | |
| CO2 | L | M | | | | | | | | |
| CO3 | L | M | S | | | | | | | |
| CO4 | | | M | | | | | | | |
| CO5 | | | L | S | | | | | | |
| CO6 | L | | | | M | S | | | | |
| CO7 | L | M | S | | | | | | | |

S - STRONG, M- MEDIUM, L – LOW

**UNIT – I JAVA FUNDAMENTALS**

Introduction to Java: Fundamentals of OOPS-Java Evolution, Java Vs C++-JVM- **Java Basics:** Java Tokens, Constants, Data Types & Variables, Operators, **Expressions :** Conditional and Unconditional Expressions - **String Handling**: String Basics, String Operations, Character Extraction, String Buffer, Arrays, Classes, objects and Methods, Final, Static - Inheritance and Its Types **Exception Handling**. : Types of Errors, Exceptions, Exception Handling Mechanisms and its classes, Advantages, Throwing User defined Exceptions

**UNIT – II INHERITANCE, PACKAGES & INTERFACE**

**Inheritance**: Inheritance Syntax and types – Multiple Inheritance, Preventing inheritance- **Interfaces**: Defining Interfaces, Extending Interfaces, Implementing Interfaces, Accessing Interfaces - **Packages:** Creating and Accessing Packages, Mechanisms of Using Packages, Hiding Classes, Import command, Roles of Accesses specifier in Implements and Extending class.

**UNIT – III MULTITHREADING, I/O & NETWORKING**

**Multithread Programming**: Fundamental Concepts, Thread Creations, Thread Life Cycle, Thread Priorities and Thread Scheduling, Thread Synchronization, InterThread Communication- **Managing I/O Files**: Concepts of I/O Streams, Stream classes, character Streams, Byte Streams, File Streams, random Access Files, and Serializations-**Exploring java.net**: InetAddress, Server Socket, socket, Datagram Packet, Datagram Socket, and Multicast Socket.

**UNIT – IV COLLECTIONS, APPLET & AWT**

**Exploring java.Util**: collections, Enumerations, iterations, String Tokenizer, Bitset, Date, Calendar, Gregorian Calendar, Time Zone, Currency-Applet Programming: **AWT**: Abstract windows toolkits, components, Containers, panels, Layouts managers, Handling Events: Listener, Interfaces and Adapter classed for various components- **Applet Fundamentals**- Java Application Vs Java Applets, Applet life Cycle, Building the Applet code, Running the Applet-Passing Parameters to Applet, Applet tag, Java Applet Package.

**UNIT - V SWING & JDBC**

**Exploring javax.swing:** JComponents, containers, Panels, Layout Managers, Basic Components, Advanced Components-components- **JDBC principles**' N-Tier Architectures, Database Drivers, JDBC-ODBC Drivers **Exploring java.sql**-connection, DriverManager, Statement,Resultset, Callable statement, prepared Statement, Resultset Metadata & Database Meta Data.

**TEXT BOOKS**

1. Herbert Schildt, "Java The Complete Reference" , 11th Edition, Tata McGraw Hill,2018. ISBN: 9781260440249
2. James Jaworski, "Java Unleashed", 4th revised edition, SAMS Techmedia Publications, Digitized-2010.

**REFERENCE BOOKS**

1. Kogent Solution Inc ,Java 6 Programming Black Book, New Ed, Dreamtech Press, 2007
2. Campione, Walrath and Huml, "The Java Tutorial", Addison Wesley,2001.
3. Elliotte Rusty Harold ,Java Network Programming, fourth Edition, O'Reilly Media, Inc.", 2013, (for Java.net package in Unit -III)
4. Java Database Programming Bible, John O' Donahue, illustrated Edition, Wiley, 2002 (for Unit -V)
5. Fundamentals of Java Programming , Authors: Ogihara, Mitsunori(2018)- ISBN 978-3-319-89491-1

| Course Code : | DATABASE MANAGEMENT SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

Fundamentals of Computer programming

**OBJECTIVES**

1. To understand the different database models and language queries to access databases.
2. To understand the SQL Query Processing through relational algebra and calculus
3. To understand the normalization forms in building an effective database tables
4. To protect the data and the database from unauthorized access and manipulation.

**COURSE OUTCOME**

On successful completion of the course the students will be able to:

To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

1. Understand database concepts, E R model and relational model
2. Understand the structures of SQLand query language, processing. Apply the SQL and PL/SQL programming with SQL tables ,Views and Embedded SQL
3. Understand Functional Dependency, apply various normalization techniques. Perform SQL queries related to Transaction Processing & Locking using concept of Concurrency control and recovery.
4. Understand the principles of storage structure and understand advanced storage mechanism.
5. Understand how to secure the designed database and to know the various database

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | S | S | | | | M | | | | | | S |
| CO2 | M | S | | | | | | L | | | M | |
| CO3 | | | | S | | | M | | | | | |
| CO4 | | | S | | S | | | M | | | L | |
| CO5 | L | | | | | M | | | L | | | S |

S -STRONG, M- MEDIUM, L- LOW

**UNIT - I**

File Systems Organization - Sequential - Purpose of Database System- Database System Terminologies-Database characteristics-DBMS Architecture - Data models – Types of data models – Components of DBMS-Relationship model - Extended ER model. LOGICAL DATABASE DESIGN: Relational DBMS - Codd's rules.

**UNIT- II**

Relational algebra - Relational calculus - Tuple relational calculus - Domain relational calculus -Integrity constraints. Data types - Database Objects- SQL Commands-DDL, DML, DCL and TCL - Aggregate operations, Joins .Query Processing and Optimization- Embedded SQL-Introduction to Views. Queries on view.PL/SQL Introduction .PL/SQL Triggers and Cursor.

**UNIT - III**

Schema Refinement - Functional dependencies - Normalization - Decomposition - Armstrong's axioms - 3NF, BCNF, 4NF - Multivalued dependencies. Denormalization. Introduction Transaction processing- Properties of Transaction- Serializability- Concurrency Control – Recovery -Locking Mechanisms- Two Phase Commit Protocol- Deadlock.

**UNIT - IV**

Overview of Physical Storage Media – Magnetic Disks – RAID Levels –File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing.

**UNIT - V**

DATABASE SECURITY: Data Classification-Threats and risks – Database access Control – Types of Privileges – Statistical Databases. Introduction to Temporal–Spatial - Multimedia - Object-oriented-XML- Mobile and Web databases.

**TEXT BOOK**

1. Silberchatz, F. Korth, and S. Sudarshan, "Database System Concepts", 6th illustrated Edition, McGraw Hill 2011

**REFERENCE BOOKS**

1. R. Elmasri and S. B. Navathe, "Fundamentals of Database Systems", 7th illustrated Edition, Pearson Education,2017
2. Raghu Ramakrishnan ,Johannes Gehrke "Database Management Systems", 3rd illustrated Edition , WCB, McGraw Hill, 2003
3. C.J. Date, "An introduction to Database Systems", 8th Edition, Pearson Education, 2006.
4. SQI, PL/SQL The Programming Language of ORACLE :4th Edition By Ivan Bayross -2010.

| Course Code : | IOT SECURITY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

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

1. Describe the basics of securing Internet of Things.
2. Explain architecture and threats in IoT.
3. Analyze various privacy schemes related to IoT
4. Describe the authentication mechanisms for IoT security and privacy.
5. Explain security issues for various applications using case studies

**UNIT – I INTRODUCTION: SECURING THE INTERNET OF THINGS**

Introduction – Security Requirements in IoT architectures – Security in Enabling Technologies – IoT Security Life Cycle – Cryptographic Fundamentals for IoT Security Engineering - Security Concerns in IoT Applications – Basic Security Practices.

**UNIT- II SECURITY ARCHITECTURE IN THE INTERNET OF THINGS**

Introduction – Security Requirements in IoT – Insufficient Authentication/Authorization – Insecure Access Control – Threads to Access Control, Privacy, and Availability – Attacks Specific to IoT – Malware Propagation and Control in Internet of Things.

**UNIT- III PRIVACY PRESERVATION**

Privacy Preservation Data Dissemination - Privacy Preservation for IoT used in Smart Building – Exploiting Mobility Social Features for Location Privacy Enhancement in Internet of Vehicles – Lightweight and Robust Schemes for Privacy Protection in Key personal IOT Applications: Mobile WBSN and Participatory Sensing.

**UNIT- IV TRUST, AUTHENTICATION AND DATA SECURITY**

Trust and Trust Models for IoT – Emerging Architecture Model for IoT Security and Privacy – preventing Unauthorized Access to Sensor Data – Authentication in IoT – Computational Security for the IoT – Secure Path Generation Scheme for real-Time Green IoT – Security Protocols for IoT Access Networks

**UNIT- V SOCIAL AWARENESS AND CASE STUDIES**

User Centric Decentralized Governance Framework for Privacy and Trust in IoT – Policy Based Approach for Informed Consent in IoT - Security and Impact of the IoT on Mobile Networks – Security Concerns in Social IoT – Security for IoT Based Healthcare – Smart cities.

**TEXT BOOKS:**

1. Shancang Li, Li Da Xu, "Securing the Internet of Things," Syngress (Elsevier) publication, 2017, ISBN: 978-0-12-804458-2.
2. Fei Hu, "Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations," CRC Press (Taylor & Francis Group), 2016, ISBN:978-1-4987-23190.
3. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A Hands-on approach," VPT Publishers, 2014, ISBN: 978-0996025515.
4. Alasdair Gilchris, "Iot Security Issues," Walter de Gruyter GmbH & Co, 2017.
5. Sridipta Misra, Muthucumaru Maheswaran, Salman Hashmi, "Security Challenges and Approaches in Internet of Things," Springer, 2016. 6. Brian Russell, Drew Van Duren, "Practical Internet of Things Security," Packet Publishing Ltd, 2016.

| Course Code : | OPERATING SYSTEMS LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 2 |

**PRE-REQUISITE**

Basic Knowledge about Unix and Linux Commands, CPU Scheduling, Process Management and Deadlocks.

**OBJECTIVES**

The objective of this lab is to teach students about various operating systems including Unix and Linux, Shell Programming, Process Communication and System Calls.

**COURSE OUTCOME**

After completion of the course the students are expected to be able to:

1. Process Synchronization used by operating systems to perform its functionalities
2. Simulation of CPU Scheduling Algorithms. (FCFS, RR, SJF, Priority, Multilevel Queuing)
3. Simulation of Banker's Algorithm for Deadlock Avoidance, Prevention
4. Program for FIFO, LRU, and OPTIMAL page replacement algorithm.

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| CO1 | H | H | | | | | | | | | M | H |
| CO2 | | M | M | H | | | | | | | | |
| CO3 | | M | M | H | | | | | | | | |
| CO4 | | M | M | H | L | | | | | | | |

H- HIGH, M- MEDIUM, L- LOW

**LIST OF EXERCISES**

1. Basic UNIX and LINUX networking commands.
2. Shell Programming.
3. Illustration of Grep, sed, awk .
4. File system related system calls.
5. Process management – Access, Chmod, Create, Exec, Fork, Getpid, Getuid, kill, lseek,
6. mount, pipe
7. Implement CPU Scheduling using
   (i) FIFOs.
   (ii) Round Robin.
8. Implement semaphore locking
9. Implement sharing memory between processes
10. Implement Server Process in the UNIX System Domain

**REFERENCES**

1. Abraham Silberschatz, Peter Baer Galvin and GregGagne, "Operating System Concepts", Ninth Edition, John Wiley & Sons (ASIA) Pvt. Ltd, 2013.
2. Maurice J. Bach, "The Design of the UNIX Operating System", Prentice/Hall International, Inc.

| Course Code : | JAVA PROGRAMMING LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 2 |

**PRE-REQUISITE**

1. Basic programming skills(c,c++)
2. Basic of Object Oriented Programming and Logical skills

**OBJECTIVES**

1. To Train the students to implement concept of OOP (Inheritance, polymorphism, encapsulation and method overloading)
2. To analyze and identify the right classes, objects, members of a class and the relationships among them needed for a specific problem by the students
3. Train the students to create and demonstrate Java application programs using sound OOP practices (e.g., interfaces and APIs) and proper program structuring (e.g., by using access control identifies, automatic documentation through comments, error exception handling)
4. Design and implement a Collection classes and integration with real time applications
5. To use testing and debugging tools to automatically discover errors of Java programs as well as use versioning tools for collaborative programming/editing.
6. Train the students to identify the Java API for the Networking and APPLET to design and implement the network and web related application for the customers demand
7. Train the student to create the N-Tier Architecture based business applications and solutions for right companies through connecting java with any databases.
8. Train the students to create a Attractive GUI based applications through SWING and AWT for the customers

**COURSE OUTCOMES**

1. Use an appropriate concepts OOP as well as the purpose and usage principles of Inheritance, polymorphism, encapsulation and method overloading for developing and Implementing required software to satisfy the customer's needs
2. Apply the concept of class, Objects, Collections classes for creating and using the appropriate software to meet the customers demand
3. Design and Implement the concept of package for API reusability to reduce the software development time and increase the efficiency of delivering software's on time to the customers.
4. Use the file reading and writing concepts to implements various software applications
5. Implement the applications by using java API concepts and testing and debugging tools to automatically discover errors of Java programs as well as use versioning tools for collaborative programming/editing
6. Design and Implementation of Connecting java with Databases to provide the solutions to the customers in N-Tier business software models to maintain the organizational information's effectively

7. Design and Implements the concept of GUI based software applications using appropriate GUI API.

**CO and PO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
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| CO1 | S | | M | | | | | | | |
| CO2 | L | M | | | | | | | | |
| CO3 | L | M | S | | | | | | | |
| CO4 | | | M | | | | | | | |
| CO5 | | | L | S | | | | | | |
| CO6 | L | | | | M | S | | | | |
| CO7 | L | M | S | | | | | | | |

S -STRONG, M- MEDIUM, L- LOW

**LIST OF PROGRAMS**

1. Simple Java Applications
    a. For understanding reference to an instance of a Class(object), methods
    b. Handling Arrays, Control statements and operators.
    c. Handling Strings in java.
2. Package Creation
    a. Developing User defined packages in java
3. Interface
    a. Developing user-defined interfaces and implementation.
    b. Use of predefined Interfaces.
4. Inheritance
    a. Handling inheritance in java
5. Threading
    a. Creation of thread in java applications.
    b. Multithreading
6. Exception Handling Mechanisms
    a. Handling pre-defined exceptions
    b. Handling user-defined exceptions
7. File operations in java
8. Applets concepts based Exercise
    a. Handling simple applet programs.
    b. Creation of color Palette.
9. Swings
    a. Handling Layouts in java
    b. Handling Different Events and Adapter classes in javax.swing
    c. Handling swing controls.
10. Database connectivity
    a. Handling backend connectivity for data retrieval

| Course Code : | DATABASE MANAGEMENT SYSTEM LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 2 |

**PRE-REQUISITE**

Co-requisite of course "Database Management Systems"

**OBJECTIVES**

1. Learn to create and use a database
2. Be familiarized with a query language
3. Have hands on experience on DDL Commands
4. Have a good understanding of DML Commands and DCL commands
5. Familiarize advanced SQL queries.
6. Be Exposed to different applications

**COURSE OUTCOMES**

1. Use typical data definitions and manipulation commands.
2. Design applications to test Nested and Join Queries
3. Implement simple applications that use Views, sequence
4. Implement applications that require a Front-end Tool
5. Develop solutions for database applications using procedures, cursors and triggers

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO2 | | S | | | | M | | | | | | M |
| CO3 | | | S | | | | | | | | | |
| CO4 | | | | | S | | | | | M | S | |
| CO5 | M | | | | S | | | L | | | M | S |

S - STRONG, M - MEDIUM, L- LOW

**LIST OF EXPERIMENTS**

1. Creation of a database and writing SQL queries to retrieve information from the Database.
2. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.
3. Performing Queries using ANY, ALL, IN, Exists, NOT EXISTS, UNION, INTERSECT, Constraints etc.
4. Queries using Aggregate functions, GROUP BY and HAVING .
5. Creation of Views, Synonyms, Sequence, Indexes, Save point.
6. Creating a database to set various constraints.
7. Normalization in Oracle (1NF, 2NF, 3NF, 4NF, 5NF) using Functional Dependencies.
8. Creating relationship between the databases and performing join, sub queries
9. PL/SQL programming:
    a. Write a PL/SQL block to satisfy some conditions by accepting input from the user.

b. Write a PL/SQL block that handles all types of exceptions.
c. Creation of Procedures and Function
d. Creation of database triggers (Creation of insert trigger, delete trigger, update trigger)
e. Creation of database with implicit and explicit cursor

10. Database design using Oracle/ MySQL /SQL Forms/MS Access only backend process forthe following
    a. Inventory Control System.
    b. Material Requirement Processing.
    c. Hospital Management System.
    d. Railway Reservation System.
    e. Personal Information System.
    f. Web Based User Identification System.
    g. Timetable Management System.
    h. Hotel Management System

# SEMESTER-VI

| Course Code : | COMPILER DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

An undergraduate course in Automata theory and theory of formal languages, design and analysis of algorithms and data structures will introduce fundamental concepts which are used in different phases of compilation.

**OBJECTIVES**

1. To introduce the major concept areas of language translation and compiler design.
2. To extend the knowledge of parser by parsing LL parser and LR parser.
3. To design the front end of the compiler, scanner, parser, intermediate code generator, object code generator and symbol table

**COURSE OUTCOME**

After completion of the course the students are expected to able to

1. Explain the concepts and different phases of compilation with compile time error handling and represent language tokens using Regular expressions.
2. Context free grammar and finite automata and design lexical analyzer for a language. Compare top down with bottom up parsers, and develop appropriate parser to produce parse tree representation of the input.
3. Design syntax directed translation schemes for a given context free grammar. Generate intermediate code for statements in high level language.
4. Apply optimization techniques to intermediate code
5. Generate machine code for high level language program.

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | H | M | | | | | | | | H | H | H |
| CO2 | L | | M | H | | | | | | | H | H |
| CO3 | | M | | H | | | | | | | M | M |
| CO4 | L | | | M | | M | | | | H | M | |
| CO5 | L | M | | M | | M | | | H | H | | L |

S -STRONG, M- MEDIUM, L- LOW

**UNIT – I INTRODUCTION TO COMPILING**

Compilers Analysis of the source program –Phases of a compiler – Cousins of the Compiler – Grouping of Phases – Compiler construction tools – Lexical Analysis –Role of Lexical Analyzer – Input Buffering –Specification of Tokens-Finite Automata-Regular expression to finite Automata- Minimization of NFA to DFA- LEX –Design of Lexical Analyzer.

**UNIT – II SYNTAX ANALYSIS**

Role of the parser –Writing Grammars –Context Free Grammars – Top Down parsing – Recursive Descent Parsing – Predictive Parsing – Bottom up parsing – Shift Reduce Parsing – Operator Precedent Parsing – LR Parsers – SLR Parser –Canonical LR Parser – LALR Parser – YACC- Design of a syntax Analyzer

**UNIT – III INTERMEDIATE CODE GENERATION**

Syntax directed translation - Intermediate code generation- Postfix notation, Three address codes-quadruples, triples and indirect triples –Syntax trees-Declarations –Assignment Statements –Boolean Expressions –Flow of control statements– Switch Case Statements – Back patching – Procedure calls.

**UNIT – IV CODE OPTIMIZATION**

Introduction – Principal Sources of Optimization –Loop optimization- Optimization of basic Blocks – DAG representation of Basic Blocks – Peephole Optimization- Basic Blocks and Flow Graphs –Basic Block-Next use Information-Flow Graphs-Representation of Flow Graphs-Loops

**UNIT – V RUN TIME ENVIRONMENTS AND CODE GENERATION**

Runtime Environments: Storage Organization – Storage Allocation strategies – Access to non-local names – Parameter Passing

Code Generation: Issues in the design of code generator – The target Language – A simple Code generator – Generate code from DAGs

**TEXT BOOKS**

1. Alfred Aho, Ravi Sethi, Jeffrey D Ullman, “Compilers Principles, Techniques and Tools”, Second Edition, Pearson Education Asia, 2006.

**REFERENCE BOOKS**

1. Allen I. Holub “Compiler Design in C”, Prentice Hall of India, 2015.
2. C. N. Fischer and R. J. LeBlanc, “Crafting a compiler with C”, Second Edition Benjamin Cummings , 2008.
3. J.P. Bennet, “Introduction to Compiler Techniques”, Second Edition, Tata McGraw-Hill, 2003
4. Raghavan V, “Principles of Compiler Design”, Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi, 2017.
5. K.D. Cooper, and Linda Torczon, Engineering a Compiler, Morgan Kaufmann, 2004.

**WEB SOURCE REFERENCES**

1. www.cse.iitd.ernet.in/~sak/courses/cdp/slides.pdf
2. http://nptel.ac.in/courses/106108052/

| Course Code : | COMPUTER NETWORKS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

1. Basics of Computer.
2. Digital Circuits.

**OBJECTIVES**

1. To develop an understanding of modern network architectures from a design and performance perspective.
2. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
3. To provide an opportunity to do network programming
4. To provide a WLAN measurement ideas.

**COURSE OUTCOMES**

1. Explain the functions of the different layer of the OSI Protocol.
2. Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.
3. For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component
4. For a given problem related TCP/IP protocol developed the network programming.
5. Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW,HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO2 | | S | | | | | | | | | | |
| CO3 | | | S | | | | | | | | M | |
| CO4 | | | | M | | | | | | | | L |
| CO5 | | | | | S | | | | | S | | |

S -STRONG, M- MEDIUM, L- LOW

**UNIT- I**

Data communication Components: Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Introduction to wireless networks:- Wi-Fi : 802.11 wireless LAN, Introduction to SDN (Software Defined Network) ,Introduction to VSN(Visual Sensor Networks) and WSN (Wireless Sensor Networks).

**UNIT-II**

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA,CSMA/CD,CDMA/CA.

**UNIT- III**

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping –ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols. Routing Algorithms, Routing in the Internet, Broadcast and Multicast Routing.

**UNIT- IV**

Transport Layer: Process to Process Communication, User Datagram Protocol(UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

**UNIT- V**

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP,HTTPS, TFTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.

**TEXT BOOKS**

1. Data Communication and Networking, 5th Edition, Behrouz A. Forouzan, McGraw-Hill.
2. Data and Computer Communication, 10th Edition, William Stallings, Pearson PrenticeHall India.

R**EFERENCE BOOKS**

1. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.
2. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
3. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

| Course Code : | OBJECT ORIENTED ANALYSIS AND DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

1. Object oriented concepts
2. Software development concepts

**OBJECTIVES**

1. To introduce the concept of Object-oriented design
2. To be familiar with problems of complex systems, evolution of object-oriented model, classes, object-oriented methodology and it notations
3. To provide the students with applications, case studies and CASE tools
4. To learn different diagram techniques of recommender system

**COURSE OUTCOMES**

1. Use an rational rose framework and explore its capabilities
2. Apply appropriate method of diagrammatic techniques.
3. Design and implement innovative features in a development process.
4. Design and implement a recommender system.
5. Examine the performance of UML with various diagrammatic presentations.

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO3 | | | S | | | | | | | | | |
| CO4 | | | | S | | | | | | | | |
| CO5 | | | | | S | | | | | | | |

S -STRONG, M- MEDIUM, L- LOW

**UNIT -I**

Object Orientation – System development – Review of objects - inheritance - Object relationship – Dynamic binding – OOSD life cycle – Process – Analysis – Design – prototyping – Implementation – Testing- Overview of Methodologies

**UNIT -II**

Rambaugh methodology, OMT – Booch methodology, Jacobson methodology – patterns – Unified approach – UML – Class diagram – Dynamic modeling.

**UNIT –III**

Introduction - UML – Meta model - Analysis and design - more information. Outline Development Process: Overview of the process-Inception - Elaboration-construction-refactoring-patternstransmission-iterative development -use cases.

**UNIT -IV**

OO Design axioms – Class visibility – refining attributes – Methods –Access layer – OODBMS – Table – class mapping view layer

**UNIT –V**

Interaction diagram-package diagram-state diagram-activity diagram-deployment diagram - UML and programming

**TEXT BOOK**

1. Ali Bahrami, “Object Oriented System Development”, McGraw-Hill International Edition 2017.

**REFERENCES**

1. Booch G., “Object oriented analysis and design”, Addison- Wesley Publishing Company 3 rd edition.
2. Rambaugh J, Blaha.M. Premeriani, W., Eddy F and Loresen W., “ObjectOriented Modeling and Design”, PHI
3. Martin Fowler, Kendall Scott, "UML Distilled", Addision Wesley
4. Eriksson, "UML Tool Kit", Addison Wesley.

| Course Code : | ARCHITECTING SMART IOT DEVICES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OUTCOMES:**

1. Get acquainted with different smart devices and smart meters
2. Describe how modern power distribution system functions
3. Identify suitable communication networks for Smart Grid applications

**Pre-requisites:**

Fundamentals of Power Distribution System, Transmission and Distribution, Power system Operation and Control, Communication Networks

**UNIT- I INTRODUCTION TO SMART GRID**

Introduction - Evolution of Electric Grid, Smart Grid Concept - Definitions and Need for Smart Grid – Functions – Opportunities – Benefits and challenges, Difference between conventional & Smart Grid, Technology Drivers

**UNIT- II ENERGY MANAGEMENT SYSTEM**

Energy Management System (EMS) - Smart substations - Substation Automation - Feeder Automation, SCADA – Remote Terminal Unit – Intelligent Electronic Devices – Protocols, Phasor Measurement Unit – Wide area monitoring protection and control, Smart integration of energy resources – Renewable, intermittent power sources – Energy Storage.

**UNIT- III DISTRIBUTION MANAGEMENT SYSTEM**

Distribution Management System (DMS) – Volt / VAR control – Fault Detection, Isolation and Service Restoration, Network Reconfiguration, Outage management System, Customer Information System, Geographical Information System, Effect of Plug in Hybrid Electric Vehicles

**UNIT- IV SMART METERS**

Introduction to Smart Meters – Advanced Metering infrastructure (AMI), AMI protocols – Standards and initiatives, Demand side management and demand response programs, Demand pricing and Time of Use, Real Time Pricing, Peak Time Pricing.

**UNIT- V COMMUNICATION NETWORKS & IOT**

Elements of communication and networking – architectures, standards, PLC, Zigbee, GSM, BPL, Local Area Network (LAN) - House Area Network (HAN) - Wide Area Network (WAN) - Broadband over Power line (BPL) - IP based Protocols - Basics of Web Service and CLOUD Computing, Cyber Security for Smart Grid.

**TEXT BOOKS:**

1. Stuart Borlase 'Smart Grid: Infrastructure, Technology and Solutions', CRC Press 2012.
2. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, 'Smart Grid: Technology and Applications', Wiley, 2012

**REFERENCE BOOKS:**

1. Mini S. Thomas, John D McDonald, 'Power System SCADA and Smart Grids', CRC Press, 2015
2. Kenneth C.Budka, Jayant G. Deshpande, Marina Thottan, 'Communication Networks for Smart Grids', Springer, 2014.

**E BOOKS:**

1. https://books.google.co.in/books?isbn=1119969093
2. https://books.google.co.in/books?isbn=135123093X

| Course Code : | COMPILER DESIGN LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 2 |

**PRE-REQUISITE**

- Automata theory and theory of formal languages
- C and C++ programming.

**OBJECTIVES**

1. To provide an Understanding of the language translation peculiarities by designing complete translator for mini language.
2. To provide practical programming skills necessary for constructing a compiler.

**COURSE OUTCOME**

After completion of the course the students are expected to able to

1. To apply the knowledge of lex tool & yacc tool to develop program for solving a scanner & parser.
2. To apply the knowledge of patterns, tokens & regular expressions in programming for solving a problem
3. To develop program to implement symbol table.
4. To learn the new code optimization techniques and apply it to improve the performance of a program in terms of speed & space.
5. To develop program for intermediate code generation.

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | H | M | | M | M | | | | H | H | H | H |
| CO2 | L | | M | H | | | | | | | H | H |
| CO3 | | M | | H | | | | H | | | M | M |
| CO4 | L | | | M | | | | | | H | L | |
| CO5 | L | M | | | | | | | H | H | | L |

H-High,M-Medium,L-Low

**LIST OF EXERCISES**

1. Check whether a string belongs to a given grammar or not
2. Check if Expression is correctly Parenthesized or not
3. Find whether given string is Keyword or not
4. Count blank space and count number of lines
5. Test whether a given identifier is valid or not
6. Simulate lexical analyzer for validating operators
7. Count Letters, digits, whitespaces and other chars in a given string
8. Implement Shift Reduce Parser
9. Find number of lines, word and characters using file operations
10. Generation of tokens for given lexeme
11. Implementation of symbol table
12. Computation of FIRST and FOLLOW sets

13. Computation of LEADING and TRAILING sets
14. Implementation of shift reduce parser
15. Implementation of Quadruples and triples
16. Generate Code from Three Address Code

**LEX and YACC**

1. Separation of Tokens
2. Implement Calculator
3. Categorize vowels and consonants in given word
4. Removal of whitespace in given sentence
5. Find whether given number is even or odd
6. Evaluate postfix expression
7. Convert infix to postfix for given expression
8. Convert infix to prefix for given expression

| Course Code : | COMPUTER NETWORKS LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 2 |

**PRE-REQUISITE**

SOFTWARE

1. C / C++ / Java / Python / Equivalent Compiler
2. Network simulator like NS2/Glomosim/OPNET/ Packet Tracer / Equivalent

**OBJECTIVES**

1. To learn and use network commands.
2. To learn socket programming.
3. To implement and analyze various network protocols.
4. To learn and use simulation tools.
5. To use simulation tools to analyze the performance of various network protocols

**COURSE OUTCOMES**

1. Implement various protocols using TCP and UDP.
2. Compare the performance of different transport layer protocols.
3. Use simulation tools to analyze the performance of various network protocols.
4. Analyze various routing algorithms
5. Implement error correction codes

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | | | | | | | | | | | |
| CO2 | | M | | | | | | | | | | |
| CO3 | | | S | | S | | | | | | L | |
| CO4 | | | | S | | | | | | | | |
| CO5 | | | | | | | | | | M | | |

S -STRONG, M- MEDIUM, L- LOW

**LIST OF EXPERIMENTS**

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine.
2. Write a program to identify your machine's host name and IP address.
3. Write a HTTP web client program to download a web page using TCP sockets.
4. Applications using TCP sockets like:
    a. Echo client and echo server
    b. Chat
    c. File Transfer
5. Write a code simulating ARP /RARP protocols.
6. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
7. Study of TCP/UDP performance using Simulation tool.

8. Simulation of Distance Vector/ Link State Routing algorithm. Write a program to obtain local DNS server's host name and IP address. Write a code for error correction code (like CRC).

| Course Code : | OPEN CV LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 2 |

**PRE-REQUISITE**

Basic Knowledge any Programming Language

**OBJECTIVES**

1. To know the fundamental concepts of image processing operations in the real World.
2. To explore various image transformation techniques.
3. To extract facial features from facial data.
4. To know image processing and text recognition operations.

**COURSE OUTCOMES**

1. Apply the basic programming concepts for image processing
2. Implement classification for images
3. Apply Research techniques for image processing
4. Perform text detection operations.

**CO and PO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | | | | | | | | | | | |
| CO2 | | | H | | | | | | | | H | |
| CO3 | | | | H | | M | | | | | | |
| CO4 | | M | | | | | | | | | | H |

S - STRONG, M- MEDIUM, L – LOW

**LIST OF PROGRAMS**

1. Basic Image Operations
2. Simple Operations for binary image processing
3. Facial Landmark detection using Dlib
4. Face recognition
5. Simple applications for image classification using Keras(Python)
6. Text detection and recognition

| Course Code : | CREATIVE AND INNOVATIVE PROJECT | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 0 | 3 |

**PRE-REQUISITE**

Basic Knowledge of systematic software development process

**OBJECTIVES**

This course explores the creative approaches of recent (and historic) innovations in business, industry, and education. Through a case study approach, this course cultivates intentional and systematic competencies in students in order to develop leaders capable of solving problems in academia or business settings. Students will draw insights from the most innovative and successful corporations to explore their approaches (Apple, IBM, and Microsoft). Students will also examine the role of failure in innovations throughout history using foundational creative-thinking concepts.

**COURSE OUTCOMES**

The Innovation and Creativity course builds a foundation in creative thinking through the examination of innovation in educational and business settings. Students will develop skills for analyzing innovations throughout the course. Students pursuing the minor in Applied Creative Thinking must earn project skills in this course.

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | | | | | | | | | | | |
| CO2 | | S | | | | | | | | | | |
| CO3 | | | S | | | | | | | | H | |
| CO4 | | | | S | | | | | | | | H |
| CO5 | | | | | S | | | | | | | M |

S -STRONG, M- MEDIUM, L- LOW

**Syllabus:**

- Develop effective creative projects that provide an

Innovative solution to real-world problems based on inquiry such as

  - class discussion,
  - critical analysis,
  - Integrative collaboration,
  - observing, and
  - Using technology.

- Innovation Case Proposal Project

# SEMESTER-VII

| Course Code : | COMPUTATIONAL BIOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 1 | 0 | 3 |

**PRE-REQUISITE**

Knowledge and awareness of the basic principles of biology, Mathematics.

**OBJECTIVES**

1. Bioinformatics is the science of storing, extracting, organizing, analyzing, interpreting and using information.
2. Approaches to the discipline of bioinformatics incorporate expertise from the biological sciences, computer science and mathematics.
3. Bioinformatics is designed for students interested in molecular biology and genetics, information technologies and computer science.

**COURSE OUTCOME**

1. knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics
2. problem-solving skills, including the ability to develop new algorithms and analysis methods.
3. an understanding of the intersection of life and information sciences, the core of shared concepts, language and skills the ability to speak the language of structure-function relationships, information theory and database queries

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | | | | | | | | | | | |
| CO2 | | S | | | | | | | | | | |
| CO3 | | | M | | | | | | | | | |
| CO4 | | | | S | | | | | | | | |
| CO5 | | | | S | | | | | | | | |

S -STRONG, M- MEDIUM, L- LOW

**UNIT- I OVERVIEW OF MEDICAL INFORMATICS**

Healthcare functions and information technology, Key Players in Health Information technology (HIT), Organizations involved with HIT. Public Health Informatics - Information systems in public health. Internet based consumer health information – telehealth and telemedicine.

**UNIT - II CLINICAL DECISION-SUPPORT SYSTEMS**

The Nature of clinical decision making, types of decisions, The role of computers in decision support-examples of clinical decision-support systems.

**UNIT – III DATABASES IN BIOINFOMATICS**

Biological databases- Types of databases**-** Examples of databases: GenBank(Genetic Sequence Databank)-NCBI(National Center for Biotechnology Information)- EMB(European Molecular Biological Laboratory)- SwissProt.

**UNIT – IV ALGORITHMS IN COMPUTING BIOLOGY**

Decision tree algorithm, Bayesian network: Bayes Theorem, Random forest algorithm, Genetic Algorithm.

**UNIT - V BIOMEDICAL DATA**

Their acquisition, storage and use, Electronic health records (EHR), Information Retrieval from Digital Libraries-PubMed, Cleveland, GENECARD.

**TEXT BOOK**

1. An introduction to bioinformatics algorithms by Neil C. Jones, Pavel Pevzner. MIT Press.2004.
2. Biomedical Informatics: computer applications in Health care and Biomedicine (3rd ed), by Shortliffe EH, Ciminio JJ., 2000, New York Springer-Verlag, ISBN 0-387-28986-0.

| Course Code : | FOG COMPUTING & ENERGY MANAGEMENT IN IOT DEVICES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Aim:**
To learn the techniques in involved in Energy harvesting and overview of Fog Computing and its architecture, challenges and applications in different context.

**Pre-Requisites:** Nil

**Objectives:**

1. Become familiar with the concepts of Fog
2. Understand the architecture and its components and working of components and its performance
3. Model the fog computing scenario
4. Understand the various energy sources and energy harvesting based sensor networks
5. Understand the various Power sources for WSN
6. Learn about the applications of Energy harvesting systems.

**UNIT- I INTRODUCTION TO FOG COMPUTING**

Fog Computing-Definition-Characteristics-Application Scenarios - Issues -Fog Computing and Internet of Things-Pros and Cons-Myths of Fog Computing -Need and Reasons for Fog Computing Fog Computing and Edge Computing-IoT , FOG, Cloud Benefits

**UNIT- II ARCHITECTURE**

Working Procedure -Performance Evaluation Components- Software Systems – Architecture-Modeling and Simulation –Challenges

**UNIT –III FOG PROTOCOLS**

Fog Protocol-Fog Kit- Proximity Detection Protocols- DDS/RTPS computing protocols.

**UNIT- IV ENERGY HARVESTING WIRELESS SENSORS**

Power sources for WSN – Power generation – conversion – examples – case studies. Harvesting micro electronic circuits – power conditioning and losses

**UNIT- V SELECTED APPLICATIONS OF ENERGY HARVESTING SYSTEMS**

Case studies for Implanted medical devices – Bio-MEMS based applications – harvesting for RF sensors and ID tags – powering wireless SHM sensor nodes.

**TEXT BOOKS:**

1. Fog Protocol and FogKit: A JSON-Based Protocol and Framework for Communication Between Bluetooth-Enabled Wearable Internet of Things Devices Spencer Lewson,by Spencer Lewson June 2015
2. Fog Computing: Helping the Internet of Things Realize its Potential Amir VahidDastjerdi and RajkumarBuyya, University of Melbourne.
3. Carlos Manuel Ferreira Carvalho, Nuno Filipe Silva VeríssimoPaulino, "CMOS Indoor Light Energy Harvesting System for Wireless Sensing Applications", springer
4. Danick Briand, Eric Yeatman, Shad Roundy ,"Micro Energy Harvesting

| Course Code : | WEB AND MOBILE APPLICATION PROGRAMMING FOR IOT & LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 2 |

**OBJECTIVES:**

1. To study and practice the basics concepts of IoT
2. Knowledge about the sensor cloud and smart automation
3. To study about the various layers and protocols in IoT
4. To know the basic concepts of data processing, cloud and fog computing in IoT.

**OUTCOMES:**

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

1. Practices with Open source tool for IoT
2. Experimenting Arduino and Intel Galileo components for IoT
3. Experimenting Advance computing and smart automation for Digital world

**LIST OF EXPERIMENTS**

1. The definition of the Internet of Things, main assumptions and perspectives: Platform for IOT devices Device architectures - Conventional and renewable power sources for resource-constrained devices - Operating systems for resource-constrained devices.
2. The data link layer for IoT: Wireless communication technologies - Wire communication technologies - Manet Networks.
3. The network layer for IOT: 6lowPAN adaptation layer for devices with limited resources. Dynamic routing protocols for wireless ad-hoc network 2 / 4
4. Communication protocols for IOT : Service oriented protocols (COAP) - Communication protocols based on the exchange of messages (MQTT) - Service discovery protocols.
5. The data processing for IOT: Organization of data processing for the Internet of things - Cloud computing - Fog computing. Applications: Smart Grid - Home Automation - Smart City.
6. Interacting with device peripherals (using GPIO, ADC, servos)
7. Connecting to the Internet (eg. the device showing the current weather forecast)
8. Exposition of device functionality as services (1) ( COAP protocol)
9. Machine-to-machine communication (broadcast communication protocols)
10. Machine-to-machine communication (communication based on the message exchange – MQTT protocol)

**RECOMMENDED LITERATURE AND TOOLS RESOURCES:**

1. Arduino, http://www.arduino.cc/
2. Intel Galileo, http://www.intel-software- academic-program.com/pages/ courses#diy
3. Moduł Copernicus, http://galaxy.agh.edu.pl/~ tszydlo/copernicus/
4. Jean-Philippe Vasseur and Adam Dunkels. Interconnecting Smart Objects with IP – The Next Internet, Morgan Kaufmann, 2010.
5. Zach Shelby, Carsten.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

(Include only Open Source Software wherever possible.)

# PROFESSIONAL ELECTIVES

| Course Code : | ADVANCED ALGORITHMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PREAMBLE:**

This subject introduces students to the advanced algorithms. On completion of this course students will be able to:

i) Demonstrate familiarity with major algorithms

ii) Determine the time complexity of algorithms

iii) Construct efficient algorithms for solving engineering problems by using appropriate algorithm

**PREREQUISITE:**

Knowledge in Design and Analysis of Algorithm

**COURSE OUTCOME**

CO1. Construct algorithms using design paradigms like divide and conquer, greedy and dynamic programming, BFS and DFS, Backtracking for a given problem.
CO2: Analyze and the performance of string matching algorithm.
CO3: Design algorithms for Approximation Algorithms like vertex cover, set cover, TSP, knapsack, bin packing, subset-sum problem and analyze their time complexity.
CO4: illustrate different types of parallel algorithms and their time complexity.
CO5: Analyze Probabilistic Algorithms & Randomized Algorithms

**MAPPING WITH PROGRAMME OUTCOMES**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | M | M | M | M | | | | | |
| CO2 | H | H | M | M | M | | | | | |
| CO3 | H | L | M | M | M | | | | | |
| CO4 | L | L | M | H | H | | | | | |
| CO5 | H | H | L | M | M | | | | | |

**UNIT - I DESIGN PARADIGMS: OVERVIEW:**

Overview of Divide and Conquer, Greedy and Dynamic Programming strategies. Basic search and traversal techniques for graphs, Backtracking, Branch and Bound.

**UNIT-II STRING MATCHING**

Introduction to string-matching problem, Naïve algorithm, Rabin Karp, Knuth Morris Pratt, Boyer- Moore algorithms and complexity analysis.

**UNIT-III APPROXIMATION ALGORITHMS**

Introduction, Combinatorial Optimization, approximation factor, PTAS, FPTAS, Approximation algorithms for vertex cover, set cover, TSP, knapsack, bin packing, subset-

sum problem etc. Analysis of the expected time complexity of the algorithms.

**UNIT-IV PARALLEL ALGORITHMS**

Introduction, Models, speedup and efficiency, Some basic techniques, Examples from graph theory, sorting, Parallel sorting networks. Parallel algorithms and their parallel time and processors complexity.

**UNIT-V PROBABILISTIC ALGORITHMS & RANDOMIZED ALGORITHMS**

Numerical probabilistic algorithms, Las Vegas and Monte Carlo algorithms, Game-theoretic techniques, Applications on graph problems

**Text Books:**

1. Introduction to Algorithms: T.H. Cormen, C.E.Leiserson and R.L. Rivest Third edition 2010
2. Fundamentals of Algorithmics : G.Brassard and P.Bratley
3. Approximation Algorithms: Vijay V.Vazirani 2013
4. Randomized Algorithms: R. Motwani and P.Raghavan First edition (2004)
5. Reference book: Algorithmics :The spirit of computing: D.Harel

| Course Code : | PARALLEL AND DISTRIBUTED ALGORITHMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

You should be comfortable programming in C and /or Java in particular. No prior knowledge of parallel computing is required.

**OBJECTIVES**

This course will facilitate the Students to analyze and identify the principles and techniques for programming the wide variety of parallel platforms currently available; able to design, develop and build a parallel processing architecture machine capable of executing logic programs. They will also learn how to solve the computational intensive applications in the cluster as well as in the cloud environment.

**COURSE OUTCOMES**

1. To demonstrate the power and purpose of parallelism and To understand different types of parallel architecture , performance of parallel programs
2. To demonstrate concepts of data and task parallelism, Independent parallelism, Introduction to Java multithreading, Fork-join parallelism. And Analyze fork and join parallelism, parallel prefix, parallel pack.
3. To understand the concepts of Mutual exclusion, Deadlocks and Parallel Computational Models and Simulating CRCW, CREW and EREW, PRAM algorithms
4. To demonstrate the concepts of Brent's Theorem, Simple parallel programs in MPI environments and Construct the task dependency graph for Quick sort algorithm
5. To demonstrate the general concepts on Distributed systems model ,message passing and peer-to-peer systems

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L | L | M | M | | | | | H | | H | H |
| CO2 | M | M | L | L | | | | | H | | H | H |
| CO3 | | | M | M | | | | | M | | H | M |
| CO4 | | | M | M | H | | | | | | L | H |
| CO5 | | | M | M | | | | | M | | M | L |

H-HIGH, M-MEDIUM, L-LOW

**UNIT - I INTRODUCTION: THE POWER AND POTENTIAL OF PARALLELISM**

The power and potential of parallelism, purpose of using parallelism, different parallel architecture, Reasoning about performance of parallel programs.

**UNIT - II DATA, TASK PARALLELISM AND JAVA MULTITHREADING**

Introduction of data and task parallelism, Independent parallelism, Introduction to Java multithreading, Fork-join parallelism, Analyze fork and join parallelism, parallel prefix, parallel pack

**UNIT - III MUTUAL EXCLUSION, DEADLOCKS AND PARALLEL COMPUTATIONAL MODELS**

Concurrency, STM, Mutual exclusion, locks, Deadlocks, race condition, Read/write locks, condition variables, Flynn's Taxonomy, PRAM, EREW, CREW, ERCW, CRCW, Simulating CRCW, CREW and EREW, PRAM algorithms. Parallel Programming Models, PVM, MPI Paradigms

**UNIT – IV PARALLEL ALGORITHMS AND PROGRAMMING LANGUAGES**

Parallel Programming Language, Brent's Theorem, Simple parallel programs in MPI environments, Parallel algorithms on network, Addition of Matrices, Multiplication of Matrices., Parallel quick sort, Synchronizing shared data structure, Shared memory

**UNIT – V DISTRIBUTED SYSTEM MODEL AND CASES**

Distributed system models, Inter process communication, Message passing, Message passing algorithm, Distributed synchronization, Consistency, replication, Cluster computing, MapReduce, Distributed storage, Wide area computing, Distributed hash table, Peer-to-peer systems.

**TEXT BOOKS**

1. "A. Grama, A. Gupta, G. Karypis and V. Kumar. Introduction to Parallel Computing (2nd edition), Addison Wesley (2002), ISBN 0-201-64865-2.
2. H. El-Rewini and T.G. Lewis. Distributed and Parallel Computing, Manning (1997), ISBN 0-13-795592-8.
3. Foster. Designing and Building Parallel Programs, Addison Wesley (1995), ISBN 0-201-57594-9.

**REFERENCES**

1. Kai Hwang and Zhiwei Xu. Scalable Parallel Computing, McGraw Hill (1998), ISBN 0-07-031798-4 2.Michael J. Quinn. Parallel Programming in C with MPI and OpenMP, McGraw Hill Education; 1st edition
2. Barry Wilkinson and Michael Allen. Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers (2nd Edition), Prentice Hall PTR (2005), ISBN 0-13-140563-2

| Course Code : | QUANTUM COMPUTING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE:** Discrete Structures

**AIM:** The basic aim of this subject is to acquire a working knowledge of quantum information theory

**OBJECTIVES:**

- To enhance the knowledge of the students with Quantum Computation.
- To learn about the concept of algebra with complex vector spaces and quantum mechanics.
- To understand why quantum computers can break certain public key cryptosystems, the engineering challenges in building a physical quantum computing

**COURSE OUTCOME(S)**

On successful completion of the course, the student will:

1. Understand the definition of qubit, quantum logic gates, quantum circuits and quantum algorithms
2. Design and understand how quantum parallelism is used in the simplest quantum algorithms such as Deutsch
3. Analyze about quantum simulation and quantum theory with the basic requirements for implementation of quantum computers
4. Analyze about various selected original scientific papers and study the concept of quantum computers and quantum information.
5. The course is designed to bring graduate students and others to the level of professional understanding such that they may begin research at the forefront of quantum computing.

**Mapping with Programme Outcome(s)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | | | | | | | | | |
| CO2 | | | S | | | | | | | |
| CO3 | | | | | M | | | | | |
| CO4 | | | | | | | | S | | |
| CO5 | | | S | | | | | | | |

S - Strong; M – Medium; L - Low

**UNIT- I**

Introduction to Quantum Computation: Quantum bits and qubit – Classical Computer and Reversibility – Review of Quantum Mechanics for Quantum Computation – Quantum Circuits – Universal gates – Computational Simulations.

**UNIT- II**

Hilbert Space methods for quantum mechanics: Hilbert spaces – Postulates of Quantum mechanics, some applications – Bipartite Quantum Entanglement - bipartite entanglement, Entanglement detection, complete positivity, open quantum systems and entanglement. Quantum probability and Quantum Information Theory – Quantum Probability, operations on probability spaces, Quantum Impossibilities and Novelties

**UNIT- III**

Quantum Entropy and Information: Quantum Entropy, Data Compression in Quantum Information Theory and Quantum Channels - Quantum Information and Cryptography: Classical Cryptography and quantum Cryptography, Eavesdropping Strategies.

**UNIT- IV**

Quantum Algorithms: Deutsch's algorithm, Deutsch's-Jozsa and Simon's algorithm, Shor's Algorithm for factorization – Grover's Algorithms for unstructured search – No Cloning Theorem – Quantum Teleportation – Bell's Theorem.

**UNIT- V**

Quantum Error Correction: Phase Flip Errors – Shor Code – Stabilizers – Pauli Group, Stabilizer analysis of Shor code – Fault Tolerant Computing.

**TEXT BOOK(s)**

1. Franklin de Lima Marquezino, Renato Portugal, Carlile Lavor "A Primer on Quantum Computing" Springer 2010
2. Fabio Benatti, Mark Fannes, Roberto Floreanini, Dimitri Petritis "Quantum Information, Computation and Cryptography" - An Introductory Survey of Theory, Technology and Experiments Springer Briefs in Computer Science 2019
3. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press. 2002
4. Pittenger A. O., An Introduction to Quantum Computing Algorithms

| Course Code : | INFORMATION THEORY AND CODING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

The aim of this course is to introduce the principles and applications of information theory. The Course will study how information is measured in terms of probability and entropy and the relationships among conditional and joint entropies with standard algorithms.

**OBJECTIVES**

1. To understand the fundamentals of Information coding techniques
2. To acquire knowledge on error control codes and block codes using various standard algorithms
3. To understand the various features of compression techniques
4. To learn about the concepts, issues, principles of audio and video compression techniques
5. To understand knowledge of a range of convolution codes with various algorithms

**COURSE OUTCOMES**

On successful completion of the course, the student will:

1. Design the channel performance using Information theory
2. Understand and Comprehend various error control code properties
3. Apply linear block codes for error detection and correction
4. Apply convolution codes for performance analysis & cyclic codes for error detection and correction
5. Design and understand about compression techniques with various Channel performance techniques

**MAPPING WITH PROGRAMME OUTCOME(S)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
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S-STRONG, M- MEDIUM, L- LOW

**UNIT - I**

**INFORMATION ENTROPY FUNDAMENTALS** - Uncertainty, Information and Entropy – Source coding Theorem – Huffman coding – Shannon Fano coding – Discrete Memory less channels – channel capacity channel coding Theorem – Channel capacity Theorem.

**UNIT - II**

**ERROR CONTROL CODING – BLOCK CODES** Linear Block codes –Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome

**UNIT - III**

**ERROR CONTROL CODING – CONVOLUTIONAL CODES** Convolutional codes – code tree, trellis, state diagram – Encoding – Decoding: Sequential search and Viterbi algorithm – Principle of Turbo coding

**UNIT - IV**

**COMPRESSION TECHNIQUES** Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards.

**UNIT - V**

**AUDIO AND VIDEO CODING** Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders – Video compression Principles – Introduction to H.261 & MPEG Video standards.

**TEXTBOOKS**

1. Simon Haykin, “Communication Systems”, John Wiley and Sons, 4thEdition, 2001.
2. Fred Halsall,“Multimedia Communications, Applications Networks Protocols and Standards”, Pearson Education, Asia 2002; Chapters: 3,4,5.

**REFERENCES**

1. Mark Nelson, “Data Compression Book”, BPB Publication 1992.
2. Watkinson J, “Compression in Video and Audio”, Focal Press, London, 1995.

| Course Code : | ADVANCED COMPUTER ARCHITECTURE | L | T | P | C |
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**PRE-REQUISITE**

1. Basic computer architecture
2. Digital fundamentals

**OBJECTIVES**

1. To understand the concept of Old computer architecture models
2. To learn and understand the Multiprocessor and Parallelel Processor Architectures
3. To understand about the different parallelism methods
4. To learn and understand how the system is interconnected with processors, memory, and other peripherals devices parallel and how it will communicate
5. To learn about the memory and cache memory concepts involved in parallel processor architecture
6. To understand the concept of pipeline and super scalar processor techniques
7. To understand about the Parallel and scalable architecture with various parameters

**COURSE OUTCOMES**

1. Apply the concept of Parallel processor architecture in designing a modern computer for the future customers needs
2. Apply the parallel and Multicore architecture in higher education for designing a modern computer architecture
3. Apply and Develop a software for the appropriate modern computer architecture through understanding parallel and multicore computer architecture
4. Use the various parallelism architecture techniques and apply for their research area in future perspectives

**CO AND PO MAPPING**

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| CO4 | L | M | | | | | | S | | |

S - STRONG, M - MEDIUM, L- LOW

**UNIT – I PARALLEL COMPUTER MODELS**

Review of Legacy computer models, the state of Computing, multiprocessors, Multicomputer, Multi vectors and SIMD computers, Architecture and Development tracks. Condition of Parallelism, Data and Resource dependencies, Hardware and Software Parallelism, Instruction level parallelism, Data Level Parallelism and Thread Level Parallelism, Program flow mechanisms, Dataflow and control flow architecture

**UNIT – II SYSTEM, PROCESSOR AND MEMORY INTERCONNECT**

System interconnects Architecture: Network Routing, Static and Dynamic Interconnect Networks, Multiprocessor Interconnects, Bus Interconnect Systems: Hierarchical, Crossbar Switch, Multiport and Multistage Interconnect Models. Processor and Memory Hierarchy: Advanced Processor Technology – RISC and CISC Scalar Processors, Superscalar Processor, VLIW Architecture and Vector and Symbolic Processor.

**UNIT – III BUS, CACHE, SHARED MEMORY**

Backplane Bus system- Cache Memory Organization- Cache addressing models, Direct and Associate Caches, Set Associative Cache Shared memory Organization-Cache coherence and Snoopy bus and Directory based Protocols - Interleaved Memory Bandwidth and Fault tolerance, Memory Allocation Scheme,

**UNIT – IV PIPELINE AND SUPER SCALAR PROCESSOR AND TECHNIQUES**

Linear and Non Linear Pipeline Processors - Asynchronous and Synchronous models, Reservation and Latency, Scheduling optimization, Instruction Pipeline- Mechanism, Dynamic instruction and Branch handling, Arithmetic Pipeline Processor Design Static and Multifunctional Arithmetic Pipeline, Superscalar and Super Pipeline Design.

**UNIT – V PARALLEL AND SCALABLE ARCHITECTURE**

Generation of Multi computers- Multi vector computers- vector processing and Multi vector multiprocessors- Compound Vector Processor- Scalable Multithreaded and Dataflow Architectures – Latency hiding techniques, Multithreading, Fine grain multicomputer-Software for parallel programming.

**TEXT BOOKS**

1. Advance Computer Architect: Parallelism, Scalability, Programmability by by Kai Hwang (Author), Naresh Jotwani (Author), 1 Jul 2017
2. Advanced Computer Architectures: A Design Space Approach by SIMA (Author)

**REFERENCE BOOKS**

1. Advanced Computer Architecture by L. Gopinath, S. Kanimozhi from Suchitra Publications
2. Computer Organization and Design The Hardware/Software Interface - David A. Patterson John L. Hennessy
3. Computer System Architecture 3e (Update) by Pearson 30 Jun 2017
4. Parallel Computer Organization and Design 1st Edition, Kindle Edition by Michel Dubois (Author), Murali Annavaram (Author), Per Stenström (Author)

| Course Code : | SOFTWARE ENGINEERING | L | T | P | C |
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**PRE-REQUISITE**

Basic Knowledge of systematic and operational language

**OBJECTIVES**

1. Apply software engineering theory, principles, tools and processes, as well as the theory and principles of computer science.
2. Design and experiment with software prototypes
3. Demonstrate professionalism including continued learning and professional activities
4. Build solutions using different technologies, architectures and life-cycle approaches in the context of different organizational structures
5. Insist the development, adoption and sustained use of standards of excellence for software engineering practices
6. Communicate effectively through software development
7. Contribute to society by behaving ethically and responsibly in software development

**COURSE OUTCOMES**

1. Basic knowledge and understanding of the analysis and design of complex systems.
2. Ability to apply **software engineering** principles and techniques.
3. Design and implement innovative features in a development process.

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| CO5 | | | | | S | | | | | | | |

S - STRONG, M- MEDIUM, L- LOW

**UNIT -I**

Introduction –Definition-S/W Engineering Paradigm – System engineering –Software characteristics -verification – validation- Software Cost Estimation Techniques-COCOMO-life cycle models-Water fall, Prototype, Evolutionary, Incremental, spiral, WINWIN Spiral, Agile

**UNIT -II**

System Analysis-Requirements analysis-Functional-Non-Functional-Analysis principlesPrototyping-Software Requirement Specification – data dictionary-data modeling, functional modeling and behavioral Modeling.

**UNIT –III**

Design Process and Principles – Software design and types- Design concepts: Abstraction, Refinement, Modularity and software architecture control hierarchy, structural partitioning and information hiding. Effective modular design: functional independence cohesion and coupling – design documentation.

**UNIT -IV**

Design Standards: -User interface design, Transform mapping and Transaction mapping. Design for Real-time Systems: System Considerations -analysis and simulation of real time Systems, Software Configuration System.

**UNIT –V**

Software Testing Techniques: Software testing fundamentals-White Box Testing-Black box testing- Software Testing Strategies: A strategic approach to software testing- Unit testing-Integration testing validation testing-system testing, Software Maintenance, Reverse Engineering and Re-Engineering.

**TEXT BOOKS**

1. Roger Pressman.S., " Software Engineering : A Practitioner's Approach",McGraw Hill 7th edition.
2. I Sommerville, " Software Engineering 10th edition: ", Addison Wesley, 2015

**REFERENCE BOOKS**

1. P fleeger, " Software Engineering ",4th Edition, Pearson Education India, 2010.
2. Carlo Ghezzi, Mehdi Jazayari, Dino Mandrioli " Fundamental of Software Engineering ", 2nd illustrated Edition, Prentice Hall of India,2003.
3. Watts S.Humphrey,"A Discipline for Software Engineering", Pearson Education, 2007.

| Course Code : | ADVANCED OPERATING SYSTEMS | L | T | P | C |
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**PRE-REQUISITE**

Basic Knowledge about Operating Systems, Processors, Synchronization and Memory Management

**COURSE OBJECTIVES**

1. To learn the fundamentals of Operating Systems
2. To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols.
3. To gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols
4. To know the components and management aspects of Real time, Mobile operating systems

**COURSE OUTCOMES**

Upon Completion of the course, the students should be able to

1. Discuss the various synchronization, scheduling and memory management issues.
2. Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of distributed operating system
3. Discuss the various resource management techniques for distributed systems
4. Identify the different features of real time and mobile operating systems
5. Install and use available open source kernel
6. Modify existing open source kernels in terms of functionality or features used

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| CO5 | | | | H | M | | | | | | | H |
| CO6 | | | | M | | | | H | | | L | H |

H- HIGH, M- MEDIUM, L- LOW

**UNIT – I FUNDAMENTALS OF OPERATING SYSTEMS**

Overview – Synchronization Mechanisms – Processes and Threads - Process Scheduling – Deadlocks: Detection, Prevention and Recovery – Models of Resources – Memory Management Techniques.

**UNIT - II DISTRIBUTED OPERATING SYSTEMS**

Issues in Distributed Operating System – Architecture – Communication Primitives – Lamport's Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols.

**UNIT – III DISTRIBUTED RESOURCE MANAGEMENT**

Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Nonblocking Commit Protocol – Security and Protection.

**UNIT - IV REAL TIME AND MOBILE OPERATING SYSTEMS**

Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems – Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems – Micro Kernel Design - Client Server Resource Access –Processes and Threads - Memory Management - File system.

**UNIT – V CASE STUDIES**

Linux System: Design Principles - Kernel Modules - Process Management Scheduling - Memory Management - Input-Output Management - File System Interprocess Communication. iOS and Android: Architecture and SDK Framework Media Layer - Services Layer - Core OS Layer - File System.

**REFERENCES**

1. Mukesh Singhal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.
2. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts", nineth Edition, John Wiley & Sons
3. Daniel P Bovet and Marco Cesati, "Understanding the Linux kernel", 3rd edition, O'Reilly, 2005.
4. Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education India, 2006.

   Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", Fourth Edition, Payload media, 2011.

| Course Code : | AD-HOC AND SENSOR NETWORKS | L | T | P | C |
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| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the basics of Ad-hoc & Sensor Networks.
- To learn various fundamental and emerging protocols of all layers
- To study about the issues pertaining to major obstacles in establishment and efficient management of Ad-hoc and sensor networks.
- To understand the nature and applications of Ad-hoc and sensor networks.
- To understand various security practices and protocols of Ad-hoc and Sensor

**PRE-REQUISITES:**

- Computer Networks and Algorithms
- Mobile Computing

**COURSE OUTCOMES**:

- Identify different issues in wireless ad hoc and sensor networks.
- To analyze protocols developed for ad hoc and sensor networks
- To identify and address the security threats in ad hoc and sensor networks.
- Establish a Sensor network environment for different types of applications.
- Knowledge about Routing Alg in ad- hoc and sensor networks.

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| CO5 | | | | | L | | | | | |

S -STRONG, M- MEDIUM, L- LOW

**UNIT - I INTRODUCTION**

Fundamentals of Wireless Communication Technology – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs) :concepts and architectures. Design Challenges in Ad hoc and Sensor Networks.

**UNIT- II MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS**

Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols- Scheduling Mechanisms & Reservation mechanism – Multi channel MAC-IEEE 802.11

**UNIT- III** **ROUTING PROTOCOLS AND TRANSPORT LAYER IN AD HOC WIRELESS NETWORKS**

Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (on-demand), hybrid routing- Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.

**UNIT – IV** **WIRELESS SENSOR NETWORKS (WSNS) AND MAC PROTOCOLS**

Single node architecture: hardware and software components of a sensor node – WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.

**UNIT – V** **WSN ROUTING, LOCALIZATION & QOS**

Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer Issues.

**TEXT BOOK:**

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Prentice Hall Professional Technical Reference, 2008.

**REFERENCES**:

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2006.
2. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication – 2002.
3. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley,2005
4. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley, 2007.
5. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

| Course Code : | INTERNET OF THINGS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

The students will be requiring participating actively in creative thinking exercises. IOT is futuristic and will require students to understand other technologies and current uses where IOT can be integrated to make a make a quantum jump in the in the efficiencies in application. A willingness to be creative and participate in open discussions is a must

**OBJECTIVES**

Students will understand the concepts of Internet of Things and can able to build IoT applications.

**COURSE OUTCOMES**

On successful completion of the course, the student will:

1. Understand the concepts of Internet of Things **[UNDERSTAND]**
2. Analyze basic protocols in wireless sensor network **[ANALYZE]**
3. Design IoT applications in different domain and be able to analyze their performance **[APPLICATION]**
4. Implement basic IoT applications on embedded platform **[CREATE]**

**MAPPING WITH PROGRAMME OUTCOMES**

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| CO3 | | | L | | | | M | | | | | S |
| CO4 | | | | | | | M | | S | | | |

S -STRONG, M- MEDIUM, L- LOW

**UNIT- I INTRODUCTION**

Introduction to IoT Defining IoT, Characteristics of IoT, IoT reference Model, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs

**UNIT – II IoT & M2M**

Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, IoT & M2M Machine to Machine, Difference between IoT and M2M, Software define Network

**UNIT – III CHALLENGES IN IoT**

Challenges in IoT Design challenges, Development challenges, Security challenges, Other challenges

**UNIT - IV IoT APPLICATIONS**

Domain specific applications of IoT Home automation, Industry applications, Surveillance applications, Other IoT applications

**UNIT - V DEVELOPING IoT**

Developing IoTs Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python **.**

**TEXTBOOK**

1. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”, 1 st Edition, VPT, 2014

**REFERENCES**

1. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"
2. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1 st Edition, Apress Publications, 2014

**INSTRUCTIONAL METHOD AND PEDAGOGY:**

At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.

1. Lectures will be conducted with the aid of multi-media projector, black board, etc.
2. Attendance is compulsory in lecture
3. Two internal exams will be conducted as a part of internal theory evaluation.
4. Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.
5. Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of five marks in the overall internal evaluation.

| Course Code : | ARTIFICIAL INTELLIGENCE | L | T | P | C |
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**OBJECTIVES**

1. Expose the history and foundations of artificial intelligence.
2. Showcase the complexity of working on real time problems underlying the need for intelligent approaches.
3. Illustrate how heuristic approaches provide a good solution mechanism.
4. Provide the mechanisms for simple knowledge representation and reasoning.
5. Highlight the complexity in working with uncertain knowledge.
6. Discuss the current and future applications of artificial intelligence

**COURSE OUTCOMES**

1. Exhibit strong familiarity with a number of important AI techniques, including in particular search, knowledge representation, and planning and constraint management.
2. Interpret the modern view of AI as the study of agents that receive percepts from the environment and perform actions.
3. Build awareness of AI facing major challenges and the complexity of typical problems within the field.
4. Assess critically the techniques presented and apply them to real world problems.
5. Develop self-learning and research skills to tackle a topic of interest on his/her own or as part of a team

**MAPPING OF COURSE OUTCOME WITH PROGRAM OUTCOMES**

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| CO2 | S | S | M | | | | M | S | | | M | |
| CO3 | M | S | | S | M | | M | S | | | | |
| CO4 | M | M | | | | | S | S | | | M | |
| CO5 | M | M | | | | | | S | S | M | | M |

S– STRONG M – MEDIUM L - LOW

**UNIT- I INTRODUCTION**

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

**UNIT- II PROBLEM SOLVING AND SEARCHING METHODS**

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing - Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games

**UNIT- III KNOWLEDGE REPRESENTATION AND REASONING**

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information

**UNIT- IV UNCERTAIN KNOWLEDGE AND REASONING**

Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

**UNIT- IV CASE STUDY AND FUTURE APPLICATIONS**

Design of a game / Solution for problem in student's domain. Natural Language processing, Robotics, Vehicular automation – Scale, Complexity, Behaviour – Controversies.

**TEXT/REFERENCE BOOKS**

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach‖, Prentice Hall, Third Edition, 2009.
2. Bratko, -Prolog: Programming for Artificial Intelligence‖, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.
3. M. Tim Jones, -Artificial Intelligence: A Systems Approach(Computer Science)‖, Jones and Bartlett Publishers, Inc.; First Edition, 2008
4. Nils J. Nilsson, -The Quest for Artificial Intelligence‖, Cambridge University Press, 2009.
5. William F. Clocksin and Christopher S. Mellish,‖ Programming in Prolog: Using the ISO Standard‖, Fifth Edition, Springer, 2003
6. Gerhard Weiss, -Multi Agent Systems‖, Second Edition, MIT Press, 2013.
7. David L. Poole and Alan K. Mackworth, -Artificial Intelligence: Foundations of
8. Computational Agents‖, Cambridge University Press, 2010.
9. Keith Frankish, William M. Ramsey (eds) The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, 2014.

| Course Code : | SOFT COMPUTING | L | T | P | C |
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**PRE-REQUISITE**

1. Familiarity with linear algebra, multivariate calculus, and probability theory
2. Knowledge of a programming language
3. Critical thinking and problem solving skills

**OBJECTIVES**

1. To introduce the ideas of fuzzy sets, fuzzy logic and fuzzy inference system.
2. To familiarize with neural networks and learning methods for neural networks.
3. To introduce basics of genetic algorithms and their applications in optimization and planning.
4. To introduce the various tools and techniques of soft computing.
5. To develop skills thorough understanding of the theoretical and practical aspects of soft computing.

**COURSE OUTCOMES**

1. Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning,
2. Reveal different applications of these models to solve engineering and other problems fuzzy inference systems, and fuzzy logic.
3. Understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations.
4. Evaluate various techniques of soft computing to defend the best working solutions.
5. Design hybrid system to revise the principles of soft computing in various applications.

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| CO5 | | | S | L | | | | | | | | |

S- STRONG, M- MEDIUM, L- LOW

**UNIT – I INTRODUCTION TO FUZZY LOGIC**

Introduction to Fuzzy - Soft computing versus hard computing- crisp sets - fuzzy sets and its relations: Cartesian product of relation – classical relation, tolerance and equivalence relations, Set-theoretic Operations – Member Function Formulation and Parameterization- Applications of soft computing.

**UNIT – II FUZZY SYSTEMS**

Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Classification, Fuzzy reasoning- Fuzzy inference systems - Fuzzy decision making Fuzzy Rule based systems, Predicate logic, Fuzzy Control Systems, Input Space Partitioning and Fuzzy Modeling.

**UNIT – III NEURAL NETWORKS**

Neural Networks: Supervised-Unsupervised Learning model- Perceptrons– Back Propagation: Mutilayer Perceptrons, Architecture. – Competitive Learning Networks – Kohonen Self-Organizing Networks – Learning Vector Quantization – Hebbian Learning.

**UNIT – IV GENETIC ALGORITHMS**

Genetic Algorithm: History - Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization.

**UNIT – V APPLICATIONS OF COMPUTATIONAL INTELLIGENCE AND HYBRID SYSTEMS**

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction. Hybrid Systems: Sequential Hybrid Systems, Auxiliary Hybrid Systems, Embedded Hybrid Systems, Neuro-Fuzzy Hybrid Systems, Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid Systems.

**TEXT BOOKS**

1. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, Third Edition, Wiley India Pvt. Limited, 2011.
2. J.S.R.Jang, C.T.Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, Pearson Education 2004.
3. S.N.Sivanandam and S.N.Deepa, “Principles of Soft Computing”, Wiley India Pvt Ltd, 3rd edition 2018.

**REFERENCES**

1. S.Rajasekaran and G.A.Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications”, Prentice-Hall of India Pvt. Ltd., 2006.
2. George J. Klir, Ute St. Clair, Bo Yuan, “Fuzzy Set Theory: Foundations and Applications” Prentice Hall, 1997.
3. David E. Goldberg, “Genetic Algorithm in Search Optimization and Machine Learning” Pearson Education India, 2013.
4. James A. Freeman, David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Education India, 1991.
5. Simon Haykin, “Neural Networks Comprehensive Foundation” Second Edition, Pearson Education, 2005.

| Course Code : | MACHINE LEARNING | L | T | P | C |
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**OBJECTIVES**

1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To have a thorough understanding of the Supervised and Unsupervised learning techniques
3. To study the various probabilities based learning techniques
4. To understand graphical models of machine learning algorithms

**COURSE OUTCOMES**

Upon completion of the course, the students will be able to: Distinguish between, supervised, unsupervised and semi-supervised learning

1. Apply the apt machine learning strategy for any given problem
2. Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem
3. Design systems that uses the appropriate Trees in Probabilities Models of machine learning
4. Modify existing machine learning algorithms to improve classification efficiency
5. Design systems that uses the appropriate graph models of machine learning

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| CO3 | L | M | M | | | | | H | H | H | M | M |
| CO4 | | L | M | | | | | | H | | M | M |
| CO5 | L | | M | M | | | | | H | H | M | H |

H- HIGH,M-MEDIUM,L-LOW

**UNIT – I INTRODUCTION**

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminates – Perceptron – Linear Separability – Linear Regression.

**UNIT – I LINEAR MODELS**

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back-Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines

**UNIT – III TREE AND PROBABILISTIC MODELS**

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map.

**UNIT – IV DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS**

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process

**UNIT - V GRAPHICAL MODELS**

Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods

**TEXT BOOKS**

1. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
2. Tom M Mitchell, ―Machine Learning‖, First Edition, McGraw Hill Education, 2013.

**REFERENCES**

1. Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data‖, First Edition, Cambridge University Press, 2012.
2. Jason Bell, ―Machine learning – Hands on for Developers and Technical Professionals‖, First Edition, Wiley, 2014
3. Ethem Alpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)‖, Third Edition, MIT Press, 2014

| Course Code : | DATAWAREHOUSING AND MINING | L | T | P | C |
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| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

Knowledge of data base management systems.

**OBJECTIVES**

1. To understand data warehouse concepts, architecture, business analysis and tools
2. To understand data pre-processing and data visualization techniques
3. To study algorithms for finding hidden and interesting patterns in data
4. To understand and apply various classification and clustering techniques using tools
5. Test real data sets using popular data mining tools such as WEKA

**COURSE OUTCOMES**

1. Design a Data warehouse system and perform business analysis with OLAP tools.
2. Apply suitable pre-processing and visualization techniques for data analysis
3. Create simple data mining applications using various functionalities of data mining
4. Apply frequent pattern and association rule mining techniques for data analysis
5. Apply appropriate classification and clustering techniques for data analysis

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| CO4 | | | | S | M | | | | | | | |
| CO5 | | | L | S | M | | | | | | | |

S- STRONG,M- MEDIUM, L- LOW

**UNIT- I DATA WAREHOUSE**

Evolution of Data base Technology - Definition: Data Warehouse - Differences between Operational Data base systems and Data Warehouses - Multidimensional Data Model - OLAP Operations - Warehouse Schema - Data Warehousing Architecture - Warehouse Server - Metadata - OLAP engine - The tasks in Building a Data Warehouse - Data warehouse backend Process - Data warehouse applications

**UNIT- II INTRODUCTION TO DATA MINING & PREPROCESSING**

Data mining: Definition - Knowledge discovery in database (KDD) vs. Data mining - DBMS vs DM - Stages of the Data Mining Process-task primitives, Data Mining Techniques -Data mining knowledge representation – Data mining query languages, Integration of a Data Mining System with a Data Warehouse – Issues, Data preprocessing – Data cleaning, Data transformation, Feature selection, Dimensionality reduction, Discretization and generating concept hierarchies

**UNIT – III CLASSIFICATION, ASSOCIATION & CLUSTERING**

Decision Tree Induction – Classification types: Bayesian Classification – Rule Based Classification – Model Evaluation, Enhancing Model Accuracy, Advanced Methods – Bayesian Belief Networks, Classification by Back propagation - Mining frequent patterns- Frequent Itemset Mining Methods, Pattern Evaluation Methods, Advanced Pattern Mining, Mining High Dimensional Data and Colossal Patterns. Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based and Grid-Based Methods, Evaluation of Clustering

**UNIT- IV MINING COMPLEX TYPES, DATA MINING APPLICATIONS AND CASE STUDIES**

Introduction to Mining Data Streams – Mining Time-Series Data – Graph Mining – Social Network Analysis, Data warehousing and mining Applications - Products - Case studies - The Future of Data Mining - Privacy and Security of Data Mining

**UNIT- V WEKA TOOL**

Datasets – Introduction, Iris plants database, Cancer database, Auto imports database – Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners

**TEXT BOOK**

Data Mining: Concepts and Techniques: Concepts and Techniques By Jiawei Han, MichelineKamber, JianPe, 3rd Edition, Elsevier, 2011

**REFERENCE BOOKS**

1. Arun K Pujari," Data mining", Third Edition, Universities Press (India) Private Limited, 2013
2. C.S.R. Prabhu, "Data Ware housing: Concepts, Techniques, Products and Applications", Third Edition, Prentice Hall of India, 2008.
3. Morgrat A. Dunham, " Data Mining: Introductory and Advanced Topics", Third Edition, Pearson Education, 2008
4. Ian H.Witten and Eibe Frank, —Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, third Edition.

| Course Code : | BIGDATA ANALYTICS | L | T | P | C |
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**PRE-REQUISITE**

1. Should have knowledge of one Programming Language (Java preferably)
2. Practice of SQL (queries and sub queries)
3. Exposure to Linux Environment

**OBJECTIVES**

1. To explore the fundamental concepts of big data analytics and its use cases.
2. To optimize business decisions and create competitive advantage with Big Data analytics.
3. Provide an overview of Apache Hadoop with Concepts and Interfacing with HDFS.
4. To introduce programming tools PIG & HIVE in Hadoop echo system.
5. To provide the learner with a comprehensive platform for career development, innovation and further studyprovide hands on Hadoop Eco System.
6. To enable the learner to identify, develop and apply detailed analytical, creative, problem solving skills.

**COURSE OUTCOMES**

1. Big Data Analytics will give ability to a student to communicate computer science concepts, designs, and solutions effectively and professionally among the research groups.
2. This course is aimed to offer training which prepare students to embark on Big Data Analytics careers which is one of the fastest growing technologies. They are also provided a very good foundation for further research analysis work.
3. Analyze InfosphereBigInsights Big Data Recommendations and access with process data on Distributed File System
4. Prepare and equip students for opportunities in ever changing technology with hands-on industrial training.
5. The Syllabus also develops requisite professional skills and problem solving abilities for pursuing a career in Software Industry.

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| CO4 | | | | M | S | | | | M | L | | |
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S- STRONG, M- MEDIUM, L- LOW

**UNIT-I INTRODUCTION TO BIG DATA**

Introduction to Big Data Analytics: Definition-overview of big data - Types of Digital Data-Characteristics– Distributed file system- Importance of Big Data, Drivers- data preparation - model planning –Usecases-critical activities in each phase of the lifecycle,Big data applications.

**UNIT- II HADOOP& R TOOL**

History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy.
Using R for Initial Analysis of the Data -Introduction to R programming, initial exploration - analysis of the data using R - basic visualization using R –Basic Scripting-Data Set Analysis

**UNIT –III MINING DATA STREAMS**

Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream.

**Link Analysis**: PageRank - Hubs and Authorities Real time Analytics Platform (RTAP) Applications - Case Studies - Real Time Sentiment Analysis- Stock Market

**UNIT –IV MAPREDUCE AND FRAMEWORKS**

MapReduce – Algorithms - Frameworks: Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphereBigInsights and Streams

**UNIT –V PREDICTIVE ANALYTICS**

Predictive Analytics- Simple linear regression- Multiple linear regression- Interpretation of regression coefficients. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications.

**TEXT BOOKS**

1. Jure Leskovec ,AnandRajaraman, Jeffrey D.Ullman, “Mining of Massive Datasets” Second Edition, Cambridge University Press, 2014.
2. Paul Zikopoulos, “Understanding Big Data”, First Edition, McGraw Hill Corporations-2012.

**REFERENCES**

1. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007. 2. Tom White “Hadoop: The Definitive Guide” Third Edition, O’reilly Media, 2012. 3. Chris Eaton, Dirk
2. Garrett Grolemund,” Introduction to Data Science with R “,O'Reilly media,2014.
3. Garrett Grolemund,”Hands-On Programming with R: Write Your Own Functions and Simulations Paperback”, O'Reilly media,2014

4. DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing, 2012.

| Course Code : | PATTERN RECOGNITION | L | T | P | C |
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**PRE-REQUISITE:**

- Fundamentals of Probability
- Digital Signal Processing
- Digital Image Processing

**OBJECTIVES:**

- Understand the concept of a pattern and the basic approach to the development of pattern recognition and machine intelligence algorithms
- Understand the basic methods of feature extraction, feature evaluation, and data mining
- Understand and apply both supervised and unsupervised classification methods to detect and characterize patterns in real-world data
- Develop prototype pattern recognition algorithms that can be used to study algorithm behavior and performance against real-world multivariate data

**COURSE OUTCOME:**

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

**Co1.** Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.

Co2. Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.

**Co3.** Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature.

**Co4.** Apply pattern recognition techniques to real-world problems such as document analysis and recognition.

**Co5.** Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.

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| CO2 | L | M | | | | | | H | | |
| CO3 | | M | | | | | | H | | H |
| CO4 | L | M | | | | | | | | H |
| CO5 | L | | | M | | | | | | H |

**UNIT- I PATTERN CLASSIFIER**

Overview of pattern recognition – Discriminant functions – Supervised learning – Parametric estimation – Maximum likelihood estimation – Bayesian parameter estimation – Perceptron algorithm – LMSE algorithm – Problems with Bayes approach – Pattern classification by distance functions – Minimum distance pattern classifier.

**UNIT- II UNSUPERVISED CLASSIFICATION**

Clustering for unsupervised learning and classification – Clustering concept – C-means algorithm – Hierarchical clustering procedures – Graph theoretic approach to pattern clustering – Validity of clustering solutions.

**UNIT- III STRUCTURAL PATTERN RECOGNITION**

Elements of formal grammars – String generation as pattern description – Recognition of syntactic description – Parsing – Stochastic grammars and applications – Graph based structural representation.

**UNIT- IV FEATURE EXTRACTION AND SELECTION**

Entropy minimization – Karhunen – Loeve transformation – Feature selection through functions approximation – Binary feature selection.

**UNIT- V RECENT ADVANCES**

Neural network structures for Pattern Recognition – Neural network based Pattern associators – Unsupervised learning in neural Pattern Recognition – Self-organizing networks – Fuzzy logic – Fuzzy pattern classifiers – Pattern classification using Genetic Algorithms.

**REFERENCES:**

1. Robert J.Schalkoff, Pattern Recognition Statistical, Structural and Neural Approaches, John Wiley & Sons Inc., New York, 1992.
2. Tou and Gonzales, Pattern Recognition Principles, Wesley Publication Company, London, 1974.
3. Duda R.O., and Har P.E., Pattern Classification and Scene Analysis, Wiley, New York, 1973.
4. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, New York, 1993.

| Course Code : | INFORMATION RETRIEVAL TECHNIQUES | L | T | P | C |
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| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

1. Data Structures and Algorithms
2. Design and Analysis of Algorithms

**OBJECTIVES**

1. To understand the basics of Information Retrieval.
2. To understand machine learning techniques for text classification and clustering.
3. To understand various search engine system operations.
4. To learn different techniques of recommender system.

**COURSE OUTCOMES**

1. Use an open source search engine framework and explore its capabilities
2. Apply appropriate method of classification or clustering.
3. Design and implement innovative features in a search engine.
4. Design and implement a recommender system.
5. Examine the performance of IR system with various metrics like precision, recall and F-Measure

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO4 | | | | S | | | | | M | | M | |
| CO5 | | | | | | L | | | | | | |

S -STRONG, M- MEDIUM, L- LOW

**UNIT -I**

**INTRODUCTION:** Basic Concepts - Retrieval Process - Modeling – Classic Information Retrieval - Set Theoretic, Algebraic and Probabilistic Models - Structured Text Retrieval Models – Retrieval Evaluation -Word Sense Disambiguation

**UNIT -II**

**QUERYING:** Languages - Key Word based Querying - Pattern Matching - Structural Queries - Query Operations - User Relevance Feedback - Local and Global Analysis - Text and Multimedia languages

**UNIT –III**

**TEXT OPERATIONS AND USER INTERFACE:** Document Preprocessing - Clustering - Text Compression - Indexing and Searching - Inverted files - Boolean Queries - Sequential searching - Pattern matching – User Interface and Visualization - Human Computer Interaction - Access Process – Starting Points - Query Specification - Context - User relevance Judgment - Interface for Search.

**UNIT -IV**

**MULTIMEDIA INFORMATION RETRIEVAL:** Data Models - Query Languages - Spatial Access Models - Generic Approach – One Dimensional Time Series - Two Dimensional Color Images - Feature Extraction

**UNIT –V**

**APPLICATIONS:** Searching the web – Challenges – Charactering the Web – Search Engines – Browsing – Meta searchers – Online IR Systems – Online Public Access Catalogs –Digital Libraries - Architectural Issues –Document Models, Representations and Access – Prototypes and Standards.

**TEXT BOOK**

1. Ricardo Baeza – Yates, Berthier Ribeiro – Neto, ―Modern Information Retrieval: The concepts and Technology behind Search‖ (ACM Press Books), Second Edition, 2011.

**REFERENCES**

1. G.G. Chowdhury, "Introduction to Modern Information Retrieval", Neal-Schuman Publishers; 3rd edition.
2. Daniel Jurafsky and James H. Martin, "Speech and Language Processing", Pearson Education, third edition2019
3. David A. Grossman, Ophir Frieder, " Information Retrieval: Algorithms, and Heuristics", Academic Press, 2000
4. Charles T. Meadow, Bert R. Boyce, Donald H. Kraft, "Text Information Retrieval Systems", 3rd edition2007

| Course Code : | NATURAL LANGUAGE PROCESSING | L | T | P | C |
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| | | 3 | 0 | 0 | 3 |

**OBJECTIVES**

- To understand the application of computational methods in linguists
- To apply statistical and probabilistic methods for parameter estimation and inference
- To know how the computational methods give insight into observed human language phenomena.

**PRE-REQUISITES**

- Programming in any high level language, preferably python or Matlab (inbuilt libraries and functions available)
- Probability and Statistics

**COURSE OUTCOMES**

1. Ability to compare and contrast approaches to natural language processing
2. Ability to comprehend and analyze the various elements of speech processing
3. Ability to design and develop machine learning techniques in the area of NLP.
4. Analyze the natural language text.
5. Generate the natural language.

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| CO4 | | | | M | | | | | | |
| CO5 | | | | | | | | M | L | |

S STRONG, M MEDIUM, L LOW

**UNIT – I**

Sound: Biology of Speech Processing; Place and Manner of Articulation; Word Boundary Detection; Argmax based computations; HMM and Speech Recognition.

**UNIT – II**

Words and Word Forms: Morphology fundamentals; Morphological Diversity of Indian Languages; Morphology Paradigms; Finite State Machine Based Morphology; Automatic Morphology Learning; Named Entities.

**UNIT – III**

Structures: Theories of Parsing, Parsing Algorithms; Robust and Scalable Parsing on Noisy Text as in Web documents; Hybrid of Rule Based and Probabilistic Parsing; Scope Ambiguity and Attachment Ambiguity resolution.

**UNIT – IV**

Meaning: Lexical Knowledge Networks, Wordnet Theory; Indian Language Wordnets and Multilingual Dictionaries; Semantic Roles; Word Sense Disambiguation; WSD and Multilinguality; Metaphors.

**UNIT – V**

Web 2.0 Applications: Sentiment Analysis; Text Entailment; Robust and Scalable Machine Translation; Question Answering in Multilingual Setting; Cross Lingual Information Retrieval (CLIR).

**TEXT BOOKS**

1. Jurafsky, Dan and Martin, James, "Speech and Language Processing", 3rdEdition, Prentice Hall, 2019
2. Manning, Christopher and Heinrich, Schutze, "Foundations of Statistical Natural Language Processing", MIT Press, 1999
3. Allen James, "Natural Language Understanding", 2nd edition, Benjamin Cumming, 1995
4. Charniack, Eugene, "Statistical Language Learning", MIT Press, 1993

| Course Code : | IMAGE PROCESSING | L | T | P | C |
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**OBJECTIVES**

1. To become familiar with digital image fundamentals
2. To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
3. To learn concepts of degradation function and restoration techniques.
4. To study the image segmentation and representation techniques.
5. To become familiar with image compression and recognition methods

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

1. Demonstrate how digital images are acquired, stored and relationship between pixels
2. Perform techniques to enhance of contrast and thereby improve the visual perception of contrast degraded imagery.
3. Remove noise from real-world imagery using a variety of filtering techniques in both the spatial and frequency domain.
4. Remove noise from real-world imagery using a variety of filtering techniques in both the spatial and frequency domain.
5. Apply image processing techniques to imagery in order to detect structures such as points, lines and edges.
6. Detect/Extract regions of interest from an image using various segmentation, representation, Description techniques and employ morphological algorithm to clean up and cluster such regions for further analysis.
7. Identify and apply these techniques to solve real-world image processing problems and propose solutions for the same.

**MAPPING WITH OUTCOME**

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| CO2 | M | M | L | L | M | M | L | M | M | M | - | L |
| CO3 | M | L | - | - | M | L | - | L | L | L | - | L |
| CO4 | L | L | - | - | L | L | - | L | L | L | - | L |
| CO5 | M | M | L | L | M | M | L | M | L | L | - | L |
| CO6 | S | S | S | S | M | S | M | S | M | M | M | M |

S -STRONG, M- MEDIUM, L- LOW

**UNIT - I**

**IMAGING TECHNOLOGIES:** Introduction to Image processing, it's need and applications- Image sensing and acquisition- CCD, CMOS, X-Ray, CT, MRI, Ultrasound, SAR, IR, Thermal- Imaging Components of an Image processing system.

**UNIT - II**

**DIGITAL IMAGE MODEL:** Illuminance and Reflectance: Image formats, Image Sampling andQuantization –Basic relationship between pixels- Connectivity and Distance measures.
**IMAGE ENHANCEMENT:** Noise models -Gray level Transformations–Histogram processing– Fourier- Discrete cosine Transform –Spatial and Frequency domain filtering – smoothing, sharpening filters.
**CODING TECHNIQUES:** JPEG, MPEG-2

**UNIT - III**

**Segmentation:** Thresholding–Threshold selection- Point, Line and Edge detection, Edgelinking, Laplacian Mask based operations- Region based segmentation – Region growing– Region splitting & merging

**UNIT - IV**

**REPRESENTATION AND DESCRIPTION:** Chain codes–Boundary descriptors– RegionalDescriptors – Texture –Morphology - dilation and erosion – opening and closing.

**UNIT - V**

**REAL WORLD IMAGE ANALYSIS:** License plate detection, CT image analysis, Non-destructivetesting, Remote sensing change detection, crack detection, Missing component detection.

**TEXT BOOK**

1. Rafael.C.Gonzalez and Richard.E. Woods, “Digital Image Processing”, Third Edition, Prentice Hall, 2008.

**REFERENCE BOOKS AND RESOURCES**

1. Rafael.C.Gonzalez, Richard.E. Woods and Steven L. Eddins, “Digital ImageProcessing using MATLAB”, 2nd Edition, Gatesmark Publishing, 2009.
2. Al.Bovik, “The Essential Guide to Image Processing”, Academic Press, 2009.
3. Anil K.Jain, “Fundamentals of Digital Image Processing”, Pearson Education 2003.
4. William K. Pratt, “Digital Image Processing”, Fourth Edition, John Wiley, 2007.
5. www.imageprocessingplace.com.
6. https://www.coursera.org/course/images.
7. http://www.mathworks.com.

| Course Code : | CLOUD INFRASTRUCTURE AND SERVICES | L | T | P | C |
|---|---|---|---|---|---|
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**PRE-REQUISITE**

Basic Knowledge of Computer Networks, Virtualization concepts.

**OBJECTIVES**

This course is offered as an elective for the Graduate students of Computer Science and Engineering / Information Technology. This course is aimed at introducing Cloud concepts, applications Of cloud computing , Virtualization concepts and disaster recovery techniques in Cloud.

**COURSE OUTCOME**

After learning the course, the student will be able:

1. To explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing. (Understanding)
2. To apply the fundamental concepts in datacenters to understand the tradeoffs in power, efficiency and cost by Load balancing approach. (Applying)
3. To discuss system virtualization and outline its role in enabling the cloud computing system model. (Remembering)
4. To analyze various cloud programming models and apply them to solve problems on the cloud. (Analysing)
5. To analyze the billing of resources and other paradigm: how to deal with disasters. (Analysing)
6. To deploy applications over commercial cloud computing infrastructures such as Amazon (Creating)

**MAPPING WITH PROGRAMME OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO2 | | | | | | | | M | | | | M |
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| CO4 | | M | | S | | | | | | | M | |
| CO5 | | | | | S | | | | | | | |
| CO6 | | | | | | S | | | | M | | H |

S -STRONG, M- MEDIUM, L- LOW

**UNIT – I CLOUD COMPUTING PRIMER**

Cloud computing characteristics, cloud definition -cloud deployment models – private, public, hybrid and community cloud, cloud services – SaaS, PaaS, and IaaS, Drivers for cloud computing, building cloud infrastructure – a phased approach- virtualization and its benefits- cloud economics and challenges.

**UNIT-II CLASSIC DATA CENTER (CDC)**

Key elements of data center - application, DBMS, compute, storage and network, server clustering, RAID technology, intelligent storage system, DAS, FC-SAN – components, port type, addressing, and zoning, IP-SAN – iSCSI and FCIP, converged network - FCoE, NAS, object based and unified storage, business continuity terminologies, backup-recovery and deduplication, local and remote replication, CDC monitoring and management, Information lifecycle strategy.

**UNIT-III VIRTUALIZED DATA CENTER (VDC)**

**COMPUTE:** Compute virtualization benefits, hypervisor types, virtual machine (VM) - resources, VM resource management, physical to virtual conversion – process, benefits.

**STORAGE:** Storage virtualization benefits, storage for VMs, block and file level storage virtualization, virtual provisioning – benefits and best practices, storage tiering.

**NETWORKING:** Network virtualization benefits, VDC network infrastructure components, VLANs, and Network traffic management techniques.

**UNIT-IV VIRTUALIZED DATA CENTER – DESKTOP AND APPLICATION**

Desktop, application, and user state virtualization – benefits, tools, and deployment methods.

**BUSINESS CONTINUITY IN VDC:-**Eliminating single points of failure, clustering, fault tolerance, and NIC teaming, backup and replication in VDC, VM templates and VM migration.

**CLOUD SECURITY:-**Basic information security concepts, cloud security concerns and threats, security mechanisms in cloud at compute, storage, and network layer, Governance, Risk and compliance in Cloud.

**UNIT-V CLOUD INFRASTRUCTURE AND MANAGEMENT**

Cloud infrastructure framework -components, infrastructure management and service creation tools- processes – asset - configuration management, service catalog management, financial management, capacity, performance availability management, incident, problem and compliance management.

**Cloud Migration Considerations:-**Considerations for choosing right application and cloud model, service provider specific considerations, cloud adoption phases, Financial and technical feasibility assessment, migration and optimization considerations.

**TEXT BOOK**

1. Cloud Infrastructure and Services Student Guide - EMC Education Services

| Course Code : | HUMAN COMPUTER INTERACTION | L | T | P | C |
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**OBJECTIVES**

This Course will enable students to

1. Describe what interaction design is and how it relates to human computer interaction and other fields
2. Explain what cognition is and why it is important for interaction design
3. Outline the nature of user frustration and how to reduce it
4. Identify some of the common pitfalls in data analysis, interpretation, and presentation
5. Explain how to do usability testing through examples

**COURSE OUTCOMES**

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

1. Design effective dialog for HCI.(L2)
2. Design effective HCI for individuals and persons with disabilities. (L3)
3. Assess the importance of user feedback. (L2)
4. Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites. (L3)
5. Develop meaningful user interface(L4)

**MAPPING OF POS & COS**

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| CO2 | | L | | H | | | M | | M | | H | |
| CO3 | H | H | | H | | H | | | | H | | H |
| CO4 | | H | L | | | M | | L | | | | H |
| CO5 | | | | H | | H | | M | | | M | |

H-HIGH,M-MEDIUM, L-LOW

**UNIT – I FOUNDATIONS OF HCI**

The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms

**UNIT – II DESIGN & SOFTWARE PROCESS**

Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines,rules. Evaluation Techniques – Universal Design

**UNIT – III MODELS AND THEORIES**

Cognitive models –Socio-Organizational issues and stake holder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.

**UNIT – IV MOBILE HCI**

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications:Widgets,Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design tools.

**UNIT – V WEB INTERFACE DESIGN**

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow.Case studies

**TEXT BOOKS**

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition,Pearson Education, 2004 (UNIT I , II& III).
2. Brian Fling, "Mobile Design and Development", First Edition , O'Reilly Media Inc., 2009 (UNIT –IV).
3. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O'Reilly, 2009.(UNIT-V).

**E-RESOURCE**

1. nptel.ac.in/courses/106103115/

| Course Code : | ROBOTIC PROCESS AUTOMATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

Students Must Have:

- Basic Programming skills

Good to Have (Not mandatory but shall accelerate the learning):

1. Lean six sigma
2. .Net, VB, C#, Javascript, HTML, SQL queries
3. Knowledge of key terminologies (OCR, Process flow, Exception handling, Bots, Algorithms)

**OBJECTIVES**

This course aims at providing knowledge of basic concepts of Robotic Process Automation to University students. It further builds on these concepts and introduces key RPA Design and Development strategies and methodologies specifically in context of UiPath products. The student undergoing the course shall develop the competence to design and develop a robot for a defined process.

**COURSE OUTCOMES**

To prepare students to be Junior RPA Developers

1. Learn the basic concepts of Robotic Process Automation Remembering
2. Understand processes which can be automated, associated business documentation basics, RPA journey of an organization Understanding
3. Develop familiarity and deep understanding of UiPath tools Creating
4. Develop ability to independently design and create robots for business processes Creating
5. Design basic and simple chat bots Creating

**MAPPING WITH PROGRAMME OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO5 | | | | | S | | | | | | | M |

S - STRONG; M – MEDIUM; L – LOW

**UNIT - I RPA CONCEPTS**

RPA Basics : History of Automation - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Standardization of processes - RPA Development methodologies -Robotic control flow

architecture - RPA business case - Process Design Document/Solution Design Document - Industries best suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem

**UNIT - II UIPATH INTRODUCTION & BASICS**

Introduction to UiPath –Variables - Control Flow - Data Manipulation - Recording and Advanced UI Interaction - Selectors

**UNIT - III ADVANCED AUTOMATION CONCEPTS AND TECHNIQUES**

Image, Text & Advanced Citrix Automation - Excel Data Tables & PDF - Email Automation - Debugging and Exception Handling - Project Organization

**UNIT IV INTRODUCTION TO ORCHESTRATOR AND EMERGING AND FUTURE TRENDS IN IT ORCHESTRATOR**

Tenants - Authentication – Users – Roles – Robots – Environments - Queues & Transactions – Schedules

**EMERGING AND FUTURE TRENDS IN IT**

Artificial Intelligence - Machine Learning - Agent awareness - Natural Language Processing - Computer Vision

**UNIT - V DEPLOYING AND MAINTAINING THE BOT**

Publishing using publish utility - Using Orchestration Server to control bots - Using Orchestration Server to deploy bots - License management - Publishing and managing updates

**TEXT BOOK:**

1. Alok Mani Tripathi - Learning Robotic Process Automation - Packt Publishing Ltd. – 2018

| Course Code : | BLOCKCHAIN TECHNOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

Good in Programming, Basic Knowledge Of Computer Security, Cryptography, Networking, Concurrent Or Parallel Programming.

**OBJECTIVES**

This course is offered as an elective for the Graduate students of Computer Science and Engineering / Information Technology. This course is aimed at introducing Blockchain concepts, use cases of Blockchain, challenges and technical gaps in cryptocurrency domain.

**COURSE OUTCOMES**

On successful completion of the course, students will be able to:

1. Familiarize the functional/operational aspects of cryptocurrency ECOSYSTEM. (CO1) Analyse
2. Understand emerging abstract models for Blockchain Technology. (CO2) Understand
3. Identify major research challenges and technical gaps existing between theory and practice in cryptocurrency domain (CO3) Evaluate

**MAPPING WITH PROGRAMME OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO2 | | | M | | | | | | | H | | |
| CO3 | | | M | | | | | | | | | M |

S - Strong; M – Medium; L - Low

**UNIT - I**

Introduction to Blockchain Basics – History- Architecture – Conceptualization - Basic Crypto Primitives - Bitcoin Basics - Distributed Consensus- Consensus in Bitcoin Basics, PoW and Beyond, The Miners.

**UNIT - II**

Basics of Permissioned Blockchain – Consensus- RAFT Consensus, Byzantine General Problem, Practical Byzantine Fault Tolerance - Overview of Blockchain for Enterprise –- Blockchain Components and Concepts

**UNIT - III**

Hyperledger Fabric details – Transaction Flow - Membership and Identity Management - Hyperledger Fabric Network Setup - Hyperledger Composer – Application Development - Hyperledger Composer – Network Administration

**UNIT - IV**

Blockchain Use Cases : Blockchain in Financial Service (Payments and Secure Trading, Compliance and Mortgage, Financial Trade) - Revolutionizing Global Trade – Supply Chain- Blockchain in Other Industries - Blockchain in Government (Advantages, Use Cases, Digital Identity) - Hyperledger Indy, Tax Payments and Land Registry Records

**UNIT - V**

**Blockchain Security:** Overview, Membership and Access control in Fabric, Privacy in Fabric Side DB

**Research Aspects:** Consensus Scalability, Bitcoin-NG, and Collective Signing, Byzcoin - Algorand, Cross Fault Tolerance, Secured Multi-Party Computation - Blockchain for Science: Blockchain for Big Data, Blockchain and AI

**Qualitative Analysis and Demo (Not to be considered for evaluation)**

Comparing Ecosystems – Ethereum- Ethereum development tools and Quorum – Corda Fabric Demo on IBM Blockchain Cloud - Fabric Demo, deploy from scratch.

**BOOKS AND REFERENCES**

1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos (Unit I)
2. Blockchain by Melanie Swa, O'Reilly (Units II,IV )
3. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric (Unit IV)
4. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html (Unit V)

**HANDS-ON BLOCKCHAIN WITH HYPERLEDGER**

1. Publisher:https://www.packtpub.com/big-data-and-business-intelligence /hands-blockchain-hyperledger
2. Amazon (Kindle and Paperback):https://www.amazon.com/Hands-Blockchain-Hyperledger-decentralized-applications/dp/1788994523
3. Public github repository with code samples: https://github.com/HyperledgerHandsOn/trade-finance-logistics

**WEB REFERENCES:**

https://swayam.gov.in/nd1_noc19_cs63/preview

| Course Code : | CRYPTOGRAPHY AND NETWORK SECURITY | L | T | P | C |
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**PRE-REQUISITE**

Operating Systems knowledge, Network architecture / administration experience. Basic knowledge of discrete mathematics (algebra), information theory and Analysis of Algorithms

**OBJECTIVES**

1. To understand the fundamentals of cryptography
2. To acquire knowledge on standard algorithms used to provide confidentiality. Integrity and authenticity
3. To understand the various key distribution and management schemes.
4. To enhance the knowledge of the students with concepts of computer network security.
5. To learn about the concepts, issues, principles of security related properties and validate using model checking.
6. To understand knowledge of a range of computer network security technologies as well as network security tools and services

**COURSE OUTCOMES**

On successful completion of the course, the student will:

1. Understand the knowledge about network security services and mechanisms.
2. Analyse about Symmetrical and Asymmetrical cryptography.
3. Analyse and Understand about the concept of Data integrity, Authentication, Digital Signatures.
4. Analyze about Various network security applications, IPSec, Firewall, IDS, Web security, Email security, and Malicious software etc.
5. Understand the security issues involved with different Network operating systems

**MAPPING WITH PROGRAMME OUTCOMES**

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| CO5 | | | | | | | | | S | | | M |

S - STRONG; M – MEDIUM; L - LOW

**UNIT - I**

Introduction to Network Security - Attacks- Services- Mechanism – Conventional Encryption Principle – Cipher Principles – Data Encryption Standard – Block Cipher Design Principles and Modes of Operation - Triple DES – Placement of Encryption Function – Traffic Confidentiality – Key Distribution.

**UNIT – II**

Introduction to Public Key Cryptography – RSA - Diffie-Hellman key Exchange – Key Management-Session and Interchange keys, Key exchange and generation-PKI

**UNIT - III**

Authentication requirements – Authentication functions – Message Authentication Codes – Hash Functions – Security of Hash Functions and MACs – MD5 message Digest algorithm - Secure Hash Algorithm – HMAC - Digital Signatures – Authentication Protocols – Digital Signature Standard

**UNIT- IV**

Authentication Applications: Kerberos – X.509 Authentication Service – Electronic Mail Security – PGP – S/MIME - IP Security – Web Security.

**UNIT- V**

Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

**TEXT BOOKS**

2. William Stallings, “Cryptography and Network Security – Principles and Practices”, March 2013
3. Forouzan, “Cryptography and Network Securiity”, November 2015
4. William Stallings, “Cryptography and Network Security – Principles and Practices”, Prentice Hall of India, Fourth Edition 2006.

| Course Code : | BUSINESS INTELLIGENCE | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES**

The student should be made to:

1. Be exposed with the basic rudiments of business intelligence system
2. Understand the modeling aspects behind Business Intelligence
3. Understand of the business intelligence life cycle and the techniques used in it
4. Be exposed with different data analysis tools and techniques

**COURSE OUTCOMES**

At the end of the course the students will be able to

1. Understand the fundamentals of business intelligence.
2. Applying link to data mining with business intelligence.
3. Apply various modeling techniques.
4. Understand the data analysis and knowledge delivery stages.
5. Apply business intelligence methods to various situations and decide on appropriate technique.

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| CO3 | | | S | | | | L | | | | M | |
| CO4 | | S | | | M | | | | | | S | |
| CO5 | S | | | S | | | | | M | | | S |

S – STRONG M – MEDIUM L - LOW

**UNIT – I BUSINESS INTELLIGENCE**

Effective and timely decisions – Data, information and knowledge – Role of mathematical models – Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence.

**UNIT – II KNOWLEDGE DELIVERY**

The business intelligence user types, Standard reports, Interactive Analysis and Ad Hoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications, Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization, Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message.

**UNIT – III EFFICIENCY**

Efficiency measures – The CCR model: Definition of target objectives- Peer groups – Identification of good operating practices; cross efficiency analysis – virtual inputs and outputs – Other models. Pattern matching – cluster analysis, outlier analysis

**UNIT – IV BUSINESS INTELLIGENCE APPLICATIONS**

Marketing models – Logistic and Production models – Case studies.

**UNIT- V FUTURE OF BUSINESS INTELLIGENCE**

Future of business intelligence – Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text Analytics – Advanced Visualization – Rich Report, Future beyond Technology.

**TEXT BOOK**

1. Efraim Turban, Ramesh Sharda, Dursun Delen, "Decision Support and Business Intelligence Systems", 9 th Edition, Pearson 2013.

**REFERENCES**

1. Larissa T. Moss, S. Atre, "Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making", Addison Wesley, 2003.
2. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley Publications, 2009.
3. David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager‟s Guide", Second Edition, 2012.
4. Cindi Howson, "Successful Business Intelligence: Secrets to Making BI a Killer App", McGraw- Hill, 2007.
5. Ralph Kimball , Margy Ross , Warren Thornthwaite, Joy Mundy, Bob Becker, "The Data Warehouse Lifecycle Toolkit", Wiley Publication Inc.,2007

# OPEN ELECTIVES

| Course Code : | CYBER LAW AND ETHICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

1. Cryptography and Network Security.
2. Ethical Hacking

**OBJECTIVES**

1. To understand the basics of cyber threats & security.
2. To learn various fundamentals of law & act
3. To study about cyber & security policies.
4. To understand the nature and applications of cyber law in real life
5. To understand various security issues in cyber.

**COURSE OUTCOMES**

1. Basic information on cybercrime.
2. Cyber laws for various crime activities.
3. Identify the security policies for cyber issues.
4. Analyze the role of organization for securing cyberspace.
5. Need for security in organizations.

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| CO3 | | | M | | | M | | | | | | |
| CO4 | | | | S | | | | | | L | | L |
| CO5 | | | | | L | | | | | | | M |

S- STRONG, M -MEDIUM, L- LOW

**UNIT – I INTRODUCTION**

Introduction, Forgery, Hacking, Software Piracy, Computer Network intrusion - Category of Cybercrime - Cybercrime Mobile & Wireless devices - Tools and Methods used in Cybercrime - Phishing & Identity Theft.

**UNIT – II CYBER CRIME**

Constitutional & Human Rights issues in cyberspace freedom of speech and Expression in cyber space, Right to access in cyber space-access to internet, Right to privacy, Right to data protection cyber crimes and legal framework, cyber crime against individual, institution and state, Hacking Digital Forgery cyber stalking /Harassment ,Cyber Pornography, identity theft & fraud, cyber terrorism ,cyber defamation.

**UNIT - III CYBER LAW**

Cyber torts cyber defamation, different types of civil wrongs under IT Act 2000,Intellectual property issues in cyber space ,interface with copyright law, interface with patent law, trademark & domain names related issues.

**UNIT - IV E-COMMERCE**

E-commerce concept-commerce-salient features online approaches like B2B,B2C & C2Conline contracts, click wrap contracts ,applicability of Indian contract act 1872.

**UNIT – V JURISDICTION**

Dispute Resolution in cyberspace, concepts of Jurisdiction, Indian context of Jurisdiction and IT Act 2000.Interantional Law and Jurisdictional issues in cyberspace.

**TEXT BOOKS**

1. Chris Reed & John Angel, Computer Law, OUP, New York.
2. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi.
3. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute.
4. Jonthan Rosenoer, Cyber Law, Springer, New York.
5. Sudhir Naib, The Information Technology Act, 2005: A Handbook, OUP, New York.
6. S. R. Bhansali, Information Technology Act, 2000, University Book House Pvt. Ltd.

**REFERENCES**

1. Reich, Pauline C, “Law, Policy, and Technology: Cyberterrorism, Information Warfare, and Internet Immobilization”, IGI Global, 2012.
2. Jennifer L. Bayuk, Jason Healey, Paul Rohmeyer, Marcus H. Sachs, Jeffrey Schmidt, “Cyber Security Policy Guidebook”, John Wiley & Sons, 2012.
3. VivekSood, “Cyber Law Simplified”, Tata Mcgraw Hill, 2001.
4. Kenneth J. Knapp, “Cyber Security and Global Information Assurance: Threat Analysis and Response Solutions”, IGI Global, 2009.
5. Jonathan Rosenoer, “Cyber law: the Law of the Internet”, Springer - verlag, 1997.

| Course Code : | DISASTER MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

Basic Knowledge of Management

**OBJECTIVES**

1. To Provide Students An Exposure To Disasters, Their Significance And Types.
2. To Ensure That Students Begin To Understand The Relationship Between Vulnerability, Disasters, Disaster Prevention And Risk Reduction
3. To Gain A Preliminary Understanding Of Approaches Of Disaster Risk Reduction (DRR)
4. To Enhance Awareness Of Institutional Processes In The Country
5. To Develop Rudimentary Ability To Respond To Their Surroundings With Potential Disaster Response In Areas Where They Live, With Due Sensitivity.

**COURSE OUTCOMES:**

1. Basic knowledge and understanding of the analysis and design of complex systems.
2. Ability to apply software engineering principles and techniques.
3. Design and implement innovative features in a development process.

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| CO3 | L | | | | | M | | | | S | | |
| CO4 | | | | | | | | S | S | M | | M |
| CO5 | L | | | | | | | S | | | | |

S - STRONG, M - MEDIUM, L - LOW

**UNIT – I INTRODUCTION TO DISASTERS**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types Of Disasters – Earthquake, Landslide, Flood, Drought, Fire Etc – Classification, Causes, Impacts Including Social, Economic, Political, Environmental, Health, Psychosocial, Etc.- Differential Impacts- In Terms Of Caste, Class, Gender, Age, Location, Disability – Global Trends In Disasters: Urban Disasters, Pandemics, Complex Emergencies, Climate Change- Dos And Don'ts During Various Types Of Disasters.

**UNIT – II APPROACHES TO DISASTER RISK REDUCTION (DRR)**

Disaster Cycle – Phases, Culture Of Safety, Prevention, Mitigation And Preparedness Community Based DRR, Structural- Nonstructural Measures, Roles And Responsibilities Of- Community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, And Other Stakeholders- Institutional Processess And Framework At State And Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories From Appropriate Agencies.

**UNIT – III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT**

Factors Affecting Vulnerabilities, Differential Impacts, Impact Of Development Projects Such As Dams, Embankments, Changes In Land-Use Etc.- Climate Change Adaptation- IPCC Scenario And Scenarios In The Context Of India – Relevance Of Indigenous Knowledge, Appropriate Technology And Local resources.

**UNIT - IV DISASTER RISK MANAGEMENT IN INDIA**

Hazard And Vulnerability Profile Of India, Components Of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional Arrangements (Mitigation, Response And Preparedness, Disaster Management Act And Policy – Other Related Policies, Plans, Programmes And Legislation – Role Of GIS And Information Technology Components In Preparedness, Risk Assessment, Response And Recovery Phases Of Disaster – Disaster Damage Assessment.

**UNIT - V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment Of Buildings And Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial And Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made Disasters: Case Studies, Space Based Inputs For Disaster Mitigation And Management And Field Works Related To Disaster Management.

**TEXTBOOKS**

1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, “Disaster Science And Management”, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge For Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study Of Disasters, IIAS And Sage Publishers, New Delhi, 2010.

**REFERENCES**

1. Govt. Of India: Disaster Management Act , Government Of India, New Delhi, 2005
2. Government Of India, National Disaster Management Policy,2009.

| Course Code : | HUMAN RESOURCE DEVELOPMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES**

1. To understand the evolution and functions of HRD
2. To identify the content, process and the outcomes of HRD applications
3. To evaluate and understand diversity issues and their impact on organizations

**COURSE OUTCOMES**

1. Differentiate between human resource development (HRD) and other human resource management functions.
2. Explain and apply significant concepts and theories underpinning HRD.
3. Develop skills in identifying HRD needs and in designing, implementing and evaluating HRD programs.
4. Explain the strategic importance of HRD in the success of organisations within the context of social and environmental pressure.

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO4 | | | | | | M | M | | | | | |

S -STRONG, M- MEDIUM, L- LOW

**UNIT - I**

Human Resource Development – Evolution of HRD - Relationship with HRM - Human Resource Development Functions - Roles and Competencies of HRD Professionals - Challenges to Organization and HRD professionals – Employee Behaviour – External and Internal Influence – Motivation as Internal Influence – Learning and HRD – Learning Strategies and Styles

**UNIT - II**

Frame work of Human Resource Development - HRD Processes - Assessing HRD Needs - HRD Model - Designing Effective HRD Program - HRD Interventions- Creating HRD Programs - Implementing HRD programs - Training Methods - Self Paced/Computer Based/ Company Sponsored Training - On-the-Job and Off-the-Job - Brain Storming - Case Studies - Role Plays - Simulations - T-Groups - Transactional Analysis.

**UNIT- III**

Evaluating HRD programs - Models and Frame Work of Evaluation - Assessing the Impact of HRD Programs - Human Resource Development Applications - Fundamental Concepts of Socialization - Realistic Job Review - Career Management and Development.

**UNIT - IV**

Management Development - Employee counseling and wellness services – Counseling as an HRD Activity - Counseling Programs - Issues in Employee Counseling - Employee Wellness and Health Promotion Programs - Organizational Strategies Based on Human Resources

**UNIT - V**

Work Force Reduction, Realignment and Retention - HR Performance and Bench Marking - Impact of Globalization on HRD- Diversity of Work Force - HRD programs for diverse employees - Expatriate & Repatriate support and development.

**REFERENCES**

1. Werner & Desimone, Human Resource Development, Cengage Learning, 2006
2. William E. Blank, Handbook For Developing Competency Based Training Programmes, Prentice-Hall, New Jersey, 1982.
3. Uday Kumar Haldar, Human Resource Development, Oxford University Press, 2009
4. Srinivas Kandula, Strategic Human Resource Developmnet, PHI Learning, 2001

| Course Code : | KNOWLEDGE MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES**

1. To familiarize the concepts of Knowledge Management.
2. To understand the challenges of Knowledge Based Organizations and the HR mechanisms to manage them effectively.
3. To identify the importance of the values of autonomy and accountability in Knowledge based organizations

**COURSE OUTCOMES**

1. Analyze personal and organizational situations in terms of theories of knowledge;
2. Analyze the knowledge needs of an organizational situation
3. Select and apply appropriate systems components and design a knowledge management system
4. Critique different forms of knowledge in light of current research.

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO3 | | | S | | M | | | | | | M | |
| CO4 | | | | S | M | | | S | | | | |

S -STRONG, M- MEDIUM, L- LOW

**UNIT - I**

Introduction to Knowledge Management - Knowledge Society - Types of Knowledge - An Introduction to life in organizations - Concept and Characteristics of KBOs - Dimensions of HRM in KBOs - New Role and Challenges for HRM in the KBOs.

**UNIT - II**

Managing Knowledge for organizational effectiveness - Process and Methods- Concept of Intellectual Capital and Learning Orientation in the Organizations - Knowledge and Role related issues - Performance Appraisal in a KBO - Intellectual Property Rights (IPR).

**UNIT - III**

Managing Knowledge and Personnel & Organizational Health - Rewarding Knowledge - Management of Retention.

**UNIT - IV**

ICTs in KBOs - HRIS for KBOs - Concept, Mechanisms, and Software Orientation - Performance Management – Mechanisms.

**UNIT-V**

Technologies to Manage Knowledge – Artificial Intelligence – Digital Libraries – Repositories – Knowledge Discovery – Creating Systems that Utilize Knowledge - Knowledge Process Outsourcing - Innovation Clusters.

**TEXT BOOK AND REFERENCES**

1. Frances Horibe, Managing Knowledge Workers, John Wiley & Sons
2. Ganesh Natarajan and Sandhya Shekhar, Knowledge Management - Enabling Business Growth, Tata McGrawHill, New Delhi
3. Fernandez & Leidner, Knowledge Management, PHI Learning, New Delhi,2008
4. Mruthyunjaya, Knowledge Management, PHI Learning, New Delhi, 2011

| Course Code : | INTELLECTUAL PROPERTY RIGHTS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

This course introduces the student to the basics of Intellectual Property Rights, Copy Right Laws Trade Marks and Issues related to Patents. The overall idea of the course is to help and encourage the student for startups and innovations.

**COURSE OBJECTIVES**

1. The main objective of the IPR is to make the students aware of their rights for the protection of their invention done in their project work.
2. To get registration in our country and foreign countries of their invention, designs and thesis or theory written by the students during their project work and for this they must have knowledge of patents, copy right, trademarks, designs and information Technology Act.
3. Further teacher will have to demonstrate with products and ask the student to identify the different types of IPR's.

**COURSE OUTCOMES**

The students once they complete their academic projects,

1. Different types of Intellectual property rights and Information technology act.
2. They gets awareness of acquiring the patent and copyright for their innovative works.
3. They also get the knowledge of plagiarism in their innovations which can be questioned legally.

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO2 | | | | | | | L | | | S | | S |
| CO3 | | | M | L | | | | | | S | | M |

S- STRONG; M-MEDIUM; L-LOW

**UNIT – I**

**INTRODUCTION:** Meaning of property, Origin, Nature, Meaning of Intellectual Property Rights, Provision of IPR under TRIPS and WTO. Kinds of Intellectual property rights—Copy Right, Patent, Trade Mark, Trade Secret and trade dress, Design, Layout Design, Geographical Indication, Plant Varieties and Traditional Knowledge.

**UNIT - II**

**PATENT RIGHTS AND COPY RIGHTS:** Origin, Meaning of Patent, Types, Inventions which are not patentable, Registration Procedure, Rights and Duties of Patentee, Assignment and license, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties.

**COPY RIGHT:** Origin, Definition &Types of Copy Right, Registration procedure, Assignment & license, Terms of Copy Right, Infringement, Remedies, Copy rights with special reference to software.

**UNIT - III**

**TRADE MARKS:** Origin, Meaning & Nature of Trade Marks, Types, Registration of Trade Marks, Infringement & Remedies, Offences relating to Trade Marks, Passing Off, Penalties.

**UNIT - IV**

**DESIGN:** Meaning, Definition, Object, Registration of Design, Cancellation of Registration, International convention of design- types and functions. Semiconductor Integrated circuits and layout design Act-2000.

**UNIT V**

**BASIC TENENTS OF INFORMATION TECHNOLOGY ACT-2000:** Cyber crimes, digital signature and E-Commerce.

**TEXT BOOKS**

1. Intellectual Property Rights and the Law (9th Edition) - Dr. G.B. Reddy, Gogia Law Agency, 2012
2. Law relating to Intellectual Property (5th Edition) - Dr. B.L.Wadehra, Universal Law Publishing Co.
3. Intellectual Property Law (3rd Edition) - P. Narayanan, Eastern Law House.
4. Law of Intellectual Property ( 6th Edition) - Dr.S.R. Myneni, Asian Law House.

| Course Code : | DIGITAL MARKETING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

The aim of the Digital Marketing Course is to provide students with the knowledge about business advantages of the digital marketing and its importance for marketing success; to develop a digital marketing plan; to make SWOT analysis; to define a target group; to get introduced to various digital channels, their advantages and ways of integration.

**OBJECTIVES**

1. To understand the concepts of digital marketing.
2. To explicate the technology catalysis in delivering value.
3. To understand online consumer behavior and concept of cyber branding.
4. To distinguish the components of a web traffic plan and SEO.
5. To develop Insights on how organizations can leverage the benefits of social media.

**COURSE OUTCOMES**

Students will be able to

1. To identify the importance of the digital marketing for marketing success **[REMEMBERING]**
2. to manage customer relationships across all digital channels and build better customer relationships **[ANALYZE]**
3. To create a digital marketing plan, starting from the SWOT analysis and defining a target group, then identifying digital channels, their advantages and limitations, to perceiving ways of their integration taking into consideration the available budget. **[CREATE]**

**MAPPING WITH PROGRAMME OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | | | | M | | | S | | | | | |
| CO2 | | | | | | | L | | | M | | |
| CO3 | L | | | | | M | | | | | | S |

S - STRONG; M – MEDIUM; L - LOW

**UNIT - I INTERNET IN THE DIGITAL ERA**

Internet, Evolving Role of Internet ,Internet Changing the world, Use of world wide web, the internet and business - online Marketing Domains - The behavioral Internet - E-Marketing - Online advertising - sales and Trade Promotion –Digital marketing,-Digital Marketing Optimization - The need for digital engagement.

**UNIT - II CUSTOMER RELATIONSHIP MANAGEMENT IN A WEB WORLD**

CRM – Needs – Goals - Benefits – CRM and the customer Life cycle - Electronic Customer Relationship management - CRM Applications - Next generation CRM - A mobile App and a community

**UNIT - III BUSINESS DRIVERS IN THE VIRTUAL WORLD**

Social Media - Social world - Social Media Analytics - Social Media Tools - The social web - Business Opportunities in Social Media, Viral Marketing - Social Curation and Brands - Inbound Marketing.

**UNIT - IV ONLINE BRANDING, TRAFFIC BUILDING, INTERNET MARKETING METRICS**

Cyber Branding - The digital brand ecosystem - Brand customer Centricity - Traffic Building: Internet traffic plan - Search Marketing methods for Traffic building - Traffic volume and quality - Search engine Marketing - Site optimization - Key word advertising - Internet Marketing Metrics - SWOT Analysis.

**UNIT - V ONLINE TOOLS FOR MARKETING**

Engagement marketing through Content Management - Online campaign management using Facebook, Twitter, Corporate Blogs - Sentiment Mining - Market influence Analytics in a Digital ecosystem - The contemporary digital Revolution-Online communities and co-creation -The future of Marketing

**TEXTBOOK**

1. Vandana Ahuja,'Digital Marketing' Oxford University Press, 2016 edition

**REFERENCES**

1. Damian Ryan, Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation Paperback – Import, Kogan Page 2014
2. Vandana Ahuja ,Digital Marketing Paperback Oxford University Press 2015
3. Hanlon Annmarie , Akins Joanna , Quickwin Digital Marketing: Answers to Your Top 100 Digital Marketing Questions Paperback PHI 2012.

**PLANNED LEARNING ACTIVITY METHODS**

Lectures, analysis of business practice examples, discussions, presentations of students' papers and case studies, exercises - students' individual and group work.

| Course Code : | ENTREPRENEURSHIP | L | T | P | C |
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**PRE-REQUISITE**

Entrepreneurs are the innovators that stimulate job growth, economic growth and development that allows any country to compete with and in the global economy. India, being far more developed and forward looking country than some of the third world countries, can provide lead to entrepreneurial development activities. The purpose of exposing the students to entrepreneurship is to motivate them to look at entrepreneurship as a viable, lucrative and preferred career. Entrepreneurs require a foundation in several key areas in order to be successful. This course will focus on multiple topics including: opportunities and challenges for new ventures, benefits/drawbacks of entrepreneurship, strategic management and forms of business ownership, marketing strategies, venture finance and human resource management.

**OBJECTIVE**

The students develop and can systematically apply an entrepreneurial way of thinking that will allow them to identify and create business opportunities that may be commercialized successfully.

**COURSE OUTCOME**

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

1. Have the ability to discern distinct entrepreneurial traits
2. Know the parameters to assess opportunities and constraints for new business ideas.
3. Understand the systematic process to select and screen a business idea
4. Design strategies for successful implementation of ideas
5. Write a business plan

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO2 | | | S | S | | M | M | | | S | M | S |
| CO3 | L | | | L | L | | | | | M | S | |
| CO4 | | | | | | | | | M | | S | |
| CO5 | | | | | | | | | L | M | | M |

S- STRONG; M-MEDIUM; L-LOW

**UNIT - I INTRODUCTION TO ENTREPRENEURSHIP**

Role of the entrepreneur in India and around the globe - forces that are driving the growth of entrepreneurship- benefits and drawbacks of entrepreneurship - mistakes of entrepreneurship and how to avoid them - entrepreneurial failure. Overview of business and its functioning - Business and industry - Components of macro and micro business environment - Business Idea and Feasibility Creativity - innovation and entrepreneurship - mental locks" that limit individual creativity - steps in the creative process - techniques for

improving the creative process - protection of intellectual property involving patents - trademarks and copyrights.

**UNIT – II STRATEGIC MANAGEMENT AND ENTREPRENEUR**

Importance of strategic management to a (small) business - understanding competitive advantages - steps in the strategic planning process; basic strategies - low-cost, differentiation, and focus - balanced scorecard in the planning process. Forms of Business Ownership Advantages and the disadvantages of the three major forms of ownership - the sole proprietorship - the partnership and the corporation. Types of franchising- trade name, product distribution, and pure - Major trends shaping franchising. Building the business plan- marketing considerations - Marketing concept and evolution - marketing process - guerilla marketing.

**UNIT - III FOUNDATIONS OF NEW VENTURE FINANCE**

Understanding capital requirements; identifying the sources of finance; angel investing and venture finance; managing cash flow. Creating the Organization - structure and design - Forms of organization structure; factors contingent on organizational structure and design.

**UNIT – IV TECHNICAL ENTREPRENEUR AND THE E-ENTREPRENEUR**

Process of creating and growing high potential ventures; basic approaches to launch an e-commerce effort Intrapreneurship Concept and importance in corporate environment.

**UNIT – V CRAFTING A WINNING BUSINESS PLAN**

Need and importance of business plan - elements of a solid business plan.

**TEXT BOOK**

1. Essentials of Entrepreneurship and Small Business management (5th edition): Thomas W. Zimmerer, and Norman M. Scarborough. PHI

**REFERENCE BOOKS**

1. Entrepreneurship: Strategies and Resources, 3rd Edition: Marc Dollinger; Prentice Hall
2. Bringing New Technology to Market- Kathleen R. Allen, Prentice Hall
3. Entrepreneurship in Action, 2nd edition - Mary Coulter; Prentice Hall.

**ONLINE RESOURCES**

1. http://ediindia.ac.in/e-policy/ [ Entepreneurial Policy India]
2. http://en.wikipedia.org/wiki/List_of_venture_capital_companies_in_India [Venture Capital]
3. indiavca.org/venture-capital-in-india.html [Venture Capital]
4. www.indianangelnetwork.com/ [ Angel Investing]
5. www.startbizindia.in/angel_investors_india.php [ANGEL INVESTING]
6. http://www.mensxp.com/work-life/entrepreneurship/21253-51-most-successful-entrepreneurs-ofindia-p1.html [ Successful Entrepreneurs]
7. Economictimes.indiatimes.com/...of...entrepreneurs/.../20912945.cms [ Leadership]

8. http://edition.cnn.com/2013/06/25/tech/innovation/frugal-innovation-india-inventors/ [ Innovation]
9. www.bplans.com/ [ BUSINESS PLAN]
10. www.entrepreneur.com/businessplan [ BUSINESS PLAN]

| Course Code : | ECONOMIC POLICIES IN INDIA | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

Indian Economy with various policies

**OBJECTIVES**

1. To understand the fundamentals of Indian Economy
2. To acquire knowledge on various developmental strategies of economic policies
3. To understand about infrastructure development.
4. To enhance the knowledge of economic policy with industrial sector.

**COURSE OUTCOMES**

On successful completion of the course, the student will:

1. Understand the knowledge about Indian economic policy
2. Analyse about developmental strategies of India.
3. Analyse and Understand about the concept of infrastructure development with economic policy.
4. Analyze about Various industrial sector with its developmental growth.
5. Understand the policies and issues involved in various economy of India.

**MAPPING WITH PROGRAMME OUTCOME(S)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO2 | | | | | | S | | | | | | |
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| CO4 | | | | | | | | | | S | | M |
| CO5 | | | | | | | | | S | | | |

S - STRONG; M – MEDIUM; L - LOW

**UNIT – I FRAMEWORK OF INDIAN ECONOMY**

Economic policy - An Introduction, Meaning and importance - National income: Trends and Structure of National Income - Demographic features and indicators of Economic Development and Growth, Rural and Urban migration.

**UNIT - II FRAMEWORK OF VARIOUS POLICIES**

Growth of Indian Population policy – Poverty, inequality, Nature, policy and implications - Employment and unemployment – Nature, Central and State Government policies and Policies implications.

**UNIT – III DEVELOPMENT STRATEGIES IN INDIA**

Agriculture - Agricultural pricing, marketing & finance policies - Economic Reforms – Rationale of Economic Reforms, Liberalization, Privatization and Globalization of the economy - Role of Public Sector – Redefining the role of public sector, Government policy towards Public sector, problems associated with privatization - Assessment of Economic Reforms.

**UNIT – IV THE ECONOMIC POLICY AND INFRASTRUCTURE DEVELOPMENT**

Energy and Transport - Social Infrastructure - Education and Health - Issues and policies in financing infrastructure Development - Indian Financial System – Money Market and Monetary Policy – financial Sector Reforms – Review of Monetary Policy of R.B.I., Capital Market in India

**UNIT- V THE ECONOMIC POLICY AND INDUSTRIAL SECTOR**

Industrial Sector in Pre–reforms Period, Growth and Pattern of Industrialization - Industrial Sector in Post – reform Period – Growth, Pattern and Small Scale Industries - Labour Market - Issues in Labour Market, Reforms & Approaches to Employment Generation.

**TEXT BOOKS**

1. Dhingra Ishwar C (2006) ; Indian Economy, Sultan Chand & Sons, New Delhi.
2. Datt, Ruddar and Sundaram, K.P.M. (2004); Indian Economy, S.Chand & Co. New Delhi.
3. Jha Raghbendra (Ed) (2003); Indian Economic Reforms, Hampshire, U.K.

**REFERENCES**

1. Government of India, Economic Survey(2004-05)
2. Brahmananda PR and V.A. Panchmukhi (Eds)(2001),Development Experience in Indian Economy,
3. Inter-State Perspectives, Bookwell, Delhi.

| Course Code : | ORGANIZATIONAL BEHAVIOUR | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**PRE-REQUISITE**

Basic knowledge of general Management

**OBJECTIVES**

1. To develop an understanding of the behavior of individuals and groups inside organizations.
2. To enhance skills in understanding and appreciating individuals, interpersonal, and group process for increased effectiveness both within and outside of organizations.
3. To develop theoretical and practical insights and problem-solving capabilities for effectively managing the organizational processes

**COURSE OUTCOMES**

1. Demonstrate the applicability of the concept of organizational behavior to understand the behavior of people in the organization.
2. Demonstrate the applicability of analyzing the complexities associated with management of individual behavior in the organization.
3. Analyze the complexities associated with management of the group behavior in the organization.
4. To identify the process used in developing communication and resolving conflicts
5. To identify the various leadership styles and the role of leaders in a decision making process
6. To discuss the implementation of organizational change

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO2 | | S | | | | | | | M | | | |
| CO3 | | | | S | | | | | | | | |
| CO4 | | | | | | M | S | | | M | | |
| CO5 | | | | | | | | | M | | S | |
| CO6 | | | M | | | | | | | | | M |

S -STRONG, M- MEDIUM, L- LOW

**UNIT – I INTRODUCTION**

Introduction to organization-organization and managers, manager' roles and skills need and importance of organizational behavior – Nature and scope – Organizational behavior models.

**UNIT – II INDIVIDUAL BEHAVIOR**

Introduction to individual behaviour, values, attitudes, job satisfaction, personality, perception and individual decision making, learning, motivation at work, managing emotions and stress

**UNIT – III GROUP BEHAVIOR**

Introduction to group behaviour, foundations of group behaviour, concept of group and group dynamics, types of groups, formal and informal groups, theories of group formation, group norms, group cohesiveness, group decision making, Interpersonal relations – Communication – Control.

**UNIT – IV LEADERSHIP AND POWER**

Meaning – Importance – Leadership styles – Theories – Leaders Vs Managers – Sources of power – Power centers – Power and Politics.

**UNIT – V ORGANIZATIONAL BEHAVIOR**

Foundations of organization structure, organization design, organization culture, organization change, managing across cultures, human resource management policies and practices, diversity at work.

**TEXT BOOKS**

1. Stephen P. Robins, Organizational Behavior, PHI Learning / Pearson Education, 11th edition, 2008.
2. Fred Luthans, Organizational Behavior, McGraw Hill, 11th Edition, 2001.

**REFERENCES**

1. Schermerhorn, Hunt and Osborn, Organizational behavior, John Wiley, 9th Edition, 2008.