# PSN College of Engineering and Technology


# Department of Computer Science and Engineering

R 2022- Curriculum (I to VIII Semester)
and
Syllabus (I to VI Semester)

## Vision and Mission of the Institute

### Vision

**Emerge as a pioneer institute inculcating engineering education and skills, research, values and ethics.**

### Mission

- **To achieve greater heights of excellence in technical knowledge and skill development through innovative teaching and learning practices.**
- **To develop the state of art infrastructure to meet the demands of technological revolution.**
- **To improve and foster research in all dimensions for betterment of society.**
- **To develop individual competencies to enhance innovation, employability and entrepreneurship among students.**
- **To instill higher standards of discipline among students, inculcating ethical and moral values for societal harmony and peace**

## Vision and Mission of the Department

### Vision

**To emerge as a preeminence program to produce quality Computer Science and Engineering graduates.**

### Mission

- **To enhance professional and entrepreneurial skills through industry institute interaction to enable them in getting better placement**
- **To promote research and continuing education**
- **To train the students according to their discipline to meet dynamic needs of the society**

## Program Outcomes (POs)

| PO's No | KNOWLEDGE | STATEMENTS |
|---|---|---|
| **1** | Engineering Knowledge: | Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| **2** | Problem Analysis: | Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| **3** | Design / Development of Solutions: | Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. |
| **4** | Conduct Investigations of Complex Problems: | Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| **5** | Modern Tool usage: | Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an UN 2 of the limitations. |
| **6** | The Engineer and Society: | Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| **7** | Environment and Sustainability: | Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. |

| | | |
|---|---|---|
| **8** | Ethics: | Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| **9** | Individual and Team Work: | Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| **10** | Communication: | Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| **11** | Project Management and Finance: | Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‟s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. |
| **12** | Life-long Learning: | Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |

**Program Educational Objectives (PEOs)**

| S.No | Topic | PEOs |
|---|---|---|
| PEO1 | **Fundamental Knowledge** | Graduates will be able to perform in technical and managerial roles ranging from design, development and problem solving to suit to the industrial needs |
| PEO2 | **Career Development** | Graduates will be able to successfully pursue higher education and also Graduates will have the ability to adapt, contribute and innovate new technologies in different domains of Computer Science and Engineering |
| PEO3 | **Social Identity** | Graduates will be ethically and socially responsible engineers in Computer Science and Engineering disciplines |

**Program Specific Outcomes (PSOs)**

**Graduating student shall be able to:**

| | |
|---|---|
| **PSO1** | The computer science and Engineering graduates are able to analyze, design, develop, test and apply Management strategy, Mathematical concept in the development of computational solutions, make them expert in computer software and hardware. |
| **PSO2** | Proficient and Innovative with a strong cognizance in the IOT, through the application of acquired knowledge and skills. |

CURRICULAM
B.E. COMPUTER SCIENCE AND ENGINEERING
Regulation R2022

| Sl.No | Course code | Course Name | Category | | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1 | IC610001 | Professional English I | ICC | Theory | 2 | 0 | 0 | 2 |
| 2 | IC610002 | Matrices and Calculus | ICC | Theory | 2 | 1 | 0 | 3 |
| 3 | IC610003 | Engineering Physics | ICC | Theory | 3 | 0 | 0 | 3 |
| 4 | IC610004 | Engineering Chemistry | ICC | Theory | 3 | 0 | 0 | 3 |
| 5 | CS610005 | Problem Solving and 'C' Programming | ICC | Theory | 3 | 0 | 0 | 3 |
| 6 | ME610006 | Engineering Graphics with CAD | ICC | Theory with Practical Component | 2 | 0 | 2 | 3 |
| 7 | IP610101 | Physics & Chemistry Laboratory | ICC | Practical | 0 | 0 | 3 | 1.5 |
| 8 | IP610102 | Programming in 'C' Laboratory | ICC | Practical | 0 | 0 | 3 | 1.5 |
| 9 | | NCC/NSS/NSO * | IMC | Institute Mandatory | 1* | 0 | 0 | 0 |
| 10 | IC610007 | Tamil marabu/Heritage of Tamil | ICC | Theory | 1 | 0 | 0 | 1 |
| | | Total | | | 17 | 1 | 8 | 21 |

**Sem - 02**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 11 | IC620008 | Professional English II | ICC | Theory with Practical Component | 2 | 0 | 2 | 3 |
| 12 | IC620009 | Transforms & Partial Differential Equations | ICC | Theory | 2 | 1 | 0 | 3 |
| 13 | IC620010 | Engineering Materials (for Non Circuit Branches) | ICC | Theory | 3 | 0 | 0 | 3 |
| | IC620011 | Semiconductor Physics(for Circuit Branches) | | | 3 | 0 | 0 | |
| 14 | ME620012 | Engineering Mechanics(for Non Circuit Branches) | PCC | Theory | 3 | 0 | 0 | 3 |
| | CS620013 | Fundamentals of Artificial Intelligence (for Circuit Branches) | | | 3 | 0 | 0 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 15 | CS620014 | Python Programming | ICC | Theory | 3 | 0 | 0 | 3 |
| 16 | EE620015 | Basic Engineering | ICC | Theory | 3 | 0 | 0 | 3 |
| 17 | IP620103 | Python Laboratory | ICC | Practical | 0 | 0 | 3 | 1.5 |
| 18 | IP620104 | Engineering practice laboratory | ICC | Practical | 0 | 0 | 3 | 1.5 |
| 19 | IM610401 | Environmental Studies | IMC | Institute Mandatory | 2* | 0 | 0 | 0 |
| 20 | IC620016 | Tamils and technology | ICC | Theory | 1 | 0 | 0 | 1 |
| | | Total | | | 19 | 1 | 8 | 22 |

**Sem - 03**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 21 | IC630017 | Numerical Methods and Statistics | ICC | Theory | 3 | 0 | 0 | 3 |
| 22 | CS630201 | Computer Organizationand Architecture | PCC | Theory | 3 | 0 | 0 | 3 |
| 23 | CS630202 | Data Structures using C++ | PCC | Theory | 3 | 0 | 0 | 3 |
| 24 | CS630203 | Database Management Systems | PCC | Theory | 3 | 0 | 0 | 3 |
| 25 | CS630204 | Operating Systems | PCC | Theory with Practical Component | 2 | 0 | 2 | 3 |
| 26 | | Professional elective-1 | PEC | Theory | 3 | 0 | 0 | 3 |
| 27 | CS630301 | Data Structures using C++ laboratory | PCC | Practical | 0 | 0 | 3 | 1.5 |
| 28 | CS630302 | Database Application laboratory | PCC | Practical | 0 | 0 | 3 | 1.5 |
| 29 | CS630501 | Integrated Aptitude Skills - I (Lower) | EEC | skill based course | 0 | 0 | 1 | 0.5# |
| 30 | IM630402 | Universal Human Values | IMC | Institute Mandatory | 2* | 0 | 0 | 0 |
| | | Total | | | 19 | 0 | 9 | 21 |

**Sem - 04**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 31 | IC640018 | Boundary value problems and probability distributions | ICC | Theory | 3 | 0 | 0 | 3 |
| 32 | EC640907 | Digital Electronics and Microprocessor | PCC | Theory with Practical Component | 2 | 0 | 2 | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 33 | CS640205 | Object Oriented Programming using JAVA | PCC | Theory | 3 | 0 | 0 | 3 |
| 34 | CS640206 | Software Engineering | PCC | Theory | 3 | 0 | 0 | 3 |
| 35 | | Professional elective-2 | PEC | Theory | 3 | 0 | 0 | 3 |
| 36 | | Institute elective -1 | IEC | Theory | 3 | 0 | 0 | 3 |
| 37 | CS640303 | Java Programming laboratory | PCC | Practical | 0 | 0 | 3 | 1.5 |
| 38 | CS640304 | Office Automation Laboratory | PCC | Practical | 0 | 0 | 3 | 1.5 |
| 39 | CS640502 | Integrated Aptitude Skills - II (Lower) | EEC | skill based course | 0 | 0 | 1 | 0.5# |
| 40 | | Inplant Training (2 Weeks) | IMC | Institute Mandatory | | | | 0 |
| | | Total | | | 17 | 0 | 9 | 21 |

**Sem - 05**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 41 | CS650207 | Computer Networks andManagement | PCC | Theory with Practical Component | 2 | 0 | 2 | 3 |
| 42 | CS650208 | Web Programming | PCC | Theory | 3 | 0 | 0 | 3 |
| 43 | CS650209 | Object Oriented Analysis and Design | PCC | Theory | 3 | 0 | 0 | 3 |
| 44 | | Institute elective -2 | IEC | Theory | 3 | 0 | 0 | 3 |
| 45 | | Professional elective-3 | PEC | Theory | 3 | 0 | 0 | 3 |
| 46 | | Professional elective-4 | PEC | Theory | 3 | 0 | 0 | 3 |
| 47 | CS650305 | Web Application development laboratory | PCC | Practical | 0 | 0 | 3 | 1.5 |
| 48 | CS650306 | Object Oriented Analysisand Design laboratory | PCC | Practical | 0 | 0 | 3 | 1.5 |
| 49 | CS650503 | Integrated Aptitude Skills - I (Higher) | EEC | skill based course | 0 | 0 | 2 | 1# |
| 50 | CS650801 | IT Project Management | PMC | Programme Mandatory | 2* | 0 | 0 | 0 |
| | | Total | | | 20 | 0 | 8 | 21 |

**Sem - 06**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 51 | CS660210 | Computer Graphics and Multimedia | PCC | Theory with Practical Component | 2 | 0 | 2 | 3 |
| 52 | CS660211 | Cloud Technologies | PCC | Theory | 3 | 0 | 0 | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 53 | CS660212 | Machine Learning | PCC | Theory | 3 | 0 | 0 | 3 |
| 54 | | Institute elective -3 | IEC | Theory | 3 | 0 | 0 | 3 |
| 55 | | Professional elective-5 | PEC | Theory | 3 | 0 | 0 | 3 |
| 56 | | Professional elective-6 | PEC | Theory | 3 | 0 | 0 | 3 |
| 57 | CS660307 | Cloud Technologies laboratory | PCC | Practical | 0 | 0 | 3 | 1.5 |
| 58 | CS660308 | Machine Learning laboratory | PCC | Practical | 0 | 0 | 3 | 1.5 |
| 59 | CS660504 | Training in IoT using arduino | EEC | skill based course | 0 | 0 | 2 | 1# |
| 60 | IM660403 | Professional Ethics | IMC | Institute Mandatory | 2* | 0 | 0 | 0 |
| 61 | | Internship | IMC | Institute Mandatory | | | | 0 |
| | | Total | | | 19 | 0 | 10 | 21 |

**Sem - 07**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 62 | CS670213 | Artificial Intelligence with Machine Learning | PCC | Theory | 2 | 0 | 2 | 3 |
| 63 | CS670214 | Advance Python Programming | PCC | Theory | 3 | 0 | 0 | 3 |
| 64 | CS670215 | Deep Learning | PCC | Theory with Practical Component | 3 | 0 | 0 | 3 |
| 65 | | Institute elective -3 | IEC | Theory | 3 | 0 | 0 | 3 |
| 66 | | Professional elective-7 | PEC | Theory | 3 | 0 | 0 | 3 |
| 67 | | Professional elective-8 | PEC | Theory | 3 | 0 | 0 | 3 |
| 68 | CS670309 | Artificial Intelligence with Machine Learning laboratory | PCC | Practical | 0 | 0 | 3 | 1.5 |
| 69 | CS670310 | Advance Python Programming laboratory | PCC | Practical | 0 | 0 | 3 | 1.5 |
| 70 | MG670019 | Innovation Entrepreneurship and Startups | ICC | Theory | 3 | 0 | 0 | 3 |
| 71 | CS670505 | Advanced career development | EEC | skill based course | 0 | 0 | 2 | 1# |
| | | Total | | | 20 | 0 | 10 | 24 |

**Sem - 08**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 72 | CS680506 | Project Work | EEC | Practical | 0 | 0 | 20 | 10 |

# The credits will not be included for CGPA calculation.
*Mandatory courses for which no credits are assigned.

| Semester wise Total credits | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SEM | I | II | III | IV | V | VI | VII | VIII | Total |
| Credit | 21 | 22 | 21 | 21 | 21 | 21 | 24 | 10 | 161 |

| Abbreviation | Particulars |
|---|---|
| ICC | Institute Core Course (includes Basic science, Engineering science, humanities & social science including management course) |
| PCC | Professional Core Course |
| PE | Professional Elective Course |
| IE | Institute Elective (open electives) |
| EEC | Employability Enhancement course |
| IMC | Institute Mandatory Course |
| PMC | Programme Mandatory Course |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Vertical 1 : Full Stack Development** | | | | | | | | |
| 1 | CS606101 | Design And Analysis of Algorithms (NPTEL) | PE | Theory | 3 | 0 | 0 | 3 |
| 2 | CS606102 | App Development | PE | Theory | 3 | 0 | 0 | 3 |
| 3 | CS606103 | PHP Programming | PE | Theory | 3 | 0 | 0 | 3 |
| 4 | CS606104 | UI and UX Design | PE | Theory | 3 | 0 | 0 | 3 |
| 5 | CS606105 | Software Testing (NPTEL) | PE | Theory | 3 | 0 | 0 | 3 |
| 6 | CS606106 | Web Application Security | PE | Theory | 3 | 0 | 0 | 3 |
| 7 | CS606107 | Dev-ops | PE | Theory | 3 | 0 | 0 | 3 |
| 8 | CS606108 | Principles of Programming Languages | PE | Theory | 3 | 0 | 0 | 3 |
| 9 | CS606109 | Social Networks (NPTEL) | PE | Theory | 3 | 0 | 0 | 3 |
| 10 | CS606110 | Multimedia Technology | PE | Theory | 3 | 0 | 0 | 3 |
| **Vertical 2: Cloud and Data Science** | | | | | | | | |
| 1 | CS606201 | Cloud Computing (NPTEL) | PE | Theory | 3 | 0 | 0 | 3 |
| 2 | CS606202 | Virtualization | PE | Theory | 3 | 0 | 0 | 3 |
| 3 | CS606203 | Cloud Computing And Distributed Systems (NPTEL) | PE | Theory | 3 | 0 | 0 | 3 |
| 4 | CS606204 | Data Warehousing | PE | Theory | 3 | 0 | 0 | 3 |
| 5 | CS606205 | Storage Technologies | PE | Theory | 3 | 0 | 0 | 3 |
| 6 | CS606206 | Software Defined Networks (Common to ECE&CSE) | PE | Theory | 3 | 0 | 0 | 3 |
| 7 | CS606207 | Grid Computing | PE | Theory | 3 | 0 | 0 | 3 |
| 8 | CS606208 | Security and Privacy in Cloud | PE | Theory | 3 | 0 | 0 | 3 |
| 9 | CS606209 | IoT and Cloud | PE | Theory | 3 | 0 | 0 | 3 |
| 10 | CS606210 | Google Cloud Computing Foundations (NPTEL) | PE | Theory | 3 | 0 | 0 | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Vertical 3: Cyber Security** | | | | | | | | |
| 1 | CS606301 | Ethical Hacking (NPTEL) | PE | Theory | 3 | 0 | 0 | 3 |
| 2 | CS606302 | Digital and Mobile Forensics | PE | Theory | 3 | 0 | 0 | 3 |
| 3 | CS606303 | Systems And Usable Security (NPTEL) | PE | Theory | 3 | 0 | 0 | 3 |
| 4 | CS606304 | Modern Cryptography | PE | Theory | 3 | 0 | 0 | 3 |
| 5 | CS606305 | Engineering Secure software systems | PE | Theory | 3 | 0 | 0 | 3 |
| 6 | CS606306 | Crypto currency and Block chain Technologies | PE | Theory | 3 | 0 | 0 | 3 |
| 7 | CS606307 | Cryptography And Network Security (NPTEL) | PE | Theory | 3 | 0 | 0 | 3 |
| 8 | CS606308 | Network Management | PE | Theory | 3 | 0 | 0 | 3 |
| 9 | CS606309 | Cyber Crime And Laws | PE | Theory | 3 | 0 | 0 | 3 |
| 10 | CS606310 | Design of Network Router | PE | Theory | 3 | 0 | 0 | 3 |
| | | | | | | | | |

| Vertical 4: INTERNET OF THINGS (Common to ECE&CSE) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | CS606401 | Introduction to Internet Of Things (NPTEL) | PE | Theory | 3 | 0 | 0 | 3 |
| 2 | CS606402 | IoT Architecture and Framework | PE | Theory | 3 | 0 | 0 | 3 |
| 3 | CS606403 | Communication Protocols For IoT | PE | Theory | 3 | 0 | 0 | 3 |
| 4 | CS606404 | Cloud Services for IoT | PE | Theory | 3 | 0 | 0 | 3 |
| 5 | CS606405 | Computer Networks And Internet Protocol (NPTEL) | PE | Theory | 3 | 0 | 0 | 3 |
| 6 | CS606406 | Privacy and Security in IoT | PE | Theory | 3 | 0 | 0 | 3 |
| 7 | CS606407 | IoT Platform for Smart City Planning | PE | Theory | 3 | 0 | 0 | 3 |
| 8 | CS606408 | IoT for Smart Grids | PE | Theory | 3 | 0 | 0 | 3 |
| 9 | CS606409 | IoT and its Applications | PE | Theory | 3 | 0 | 0 | 3 |
| 10 | CS606410 | Introduction To Industry 4.0 And Industrial Internet Of Things (NPTEL) | PE | Theory | 3 | 0 | 0 | 3 |

| Vertical 5: Block chain | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | CS606501 | Foundations of Cryptography (NPTEL) | PE | Theory | 3 | 0 | 0 | 3 |
| 2 | CS606502 | Blockchain And Its Applications (NPTEL) | PE | Theory | 3 | 0 | 0 | 3 |
| 3 | CS606503 | Blockchain Technologies | PE | Theory | 3 | 0 | 0 | 3 |
| 4 | CS606504 | Blockchain Architecture Design And Use Cases (NPTEL) | PE | Theory | 3 | 0 | 0 | 3 |
| 5 | CS606505 | Blockchain Platforms | PE | Theory | 3 | 0 | 0 | 3 |
| 6 | CS606506 | Blockchain Forensics | PE | Theory | 3 | 0 | 0 | 3 |
| 7 | CS606507 | Robot Manipulator Control | PE | Theory | 3 | 0 | 0 | 3 |
| 8 | CS606508 | Computer Vision With Open cv | PE | Theory | 3 | 0 | 0 | 3 |
| 9 | CS606509 | Internet Security | PE | Theory | 3 | 0 | 0 | 3 |
| 10 | CS606510 | Intelligent Transport Systems | PE | Theory | 3 | 0 | 0 | 3 |

| Vertical 6: DIVERSIFIED COURSES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | CS606601 | Data Analytics With Python (NPTEL) | PE | Theory | 3 | 0 | 0 | 3 |
| 2 | CS606602 | Problem Solving Using Python | PE | Theory | 3 | 0 | 0 | 3 |
| 3 | CS606603 | Data Science For Engineers (NPTEL) | PE | Theory | 3 | 0 | 0 | 3 |
| 4 | CS606604 | Database Design (NPTEL) | PE | Theory | 3 | 0 | 0 | 3 |
| 5 | CS606605 | Matlab Programming For Engineers | PE | Theory | 3 | 0 | 0 | 3 |
| 6 | CS606606 | Robotics And Its Applications | PE | Theory | 3 | 0 | 0 | 3 |
| 7 | CS606607 | Adhoc Networks | PE | Theory | 3 | 0 | 0 | 3 |
| 8 | CS606608 | Principles of Distributed Systems | PE | Theory | 3 | 0 | 0 | 3 |
| 9 | CS606609 | Python Scripting | PE | Theory | 3 | 0 | 0 | 3 |
| 10 | CS606610 | Implement Rust | PE | Theory | 3 | 0 | 0 | 3 |

| Vertical 7: Artificial Intelligence | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | CS606701 | Artificial Intelligence In Finance | PE | Theory | 3 | 0 | 0 | 3 |
| 2 | CS606702 | Optimization For Machine Learning (Nptel) | PE | Theory | 3 | 0 | 0 | 3 |
| 3 | CS606703 | Design Thinking In Artificial Intelligence | PE | Theory | 3 | 0 | 0 | 3 |
| 4 | CS606704 | Artificial Intelligence And Reinforcement Learning | PE | Theory | 3 | 0 | 0 | 3 |
| 5 | CS606705 | Machine Learning For Soil And Crop Management (Nptel) | PE | Theory | 3 | 0 | 0 | 3 |
| 6 | CS606706 | Computational Intelligence | PE | Theory | 3 | 0 | 0 | 3 |
| 7 | CS606707 | Deep Learning For Visual Computing (Nptel) | PE | Theory | 3 | 0 | 0 | 3 |
| 8 | CS606708 | Soft Computing | PE | Theory | 3 | 0 | 0 | 3 |
| 9 | CS606709 | Text And Speech Analysis | PE | Theory | 3 | 0 | 0 | 3 |
| 10 | CS606710 | Machine Learning Techniques | PE | Theory | 3 | 0 | 0 | 3 |

**INSTITUTE ELECTIVE I**

| S.No | Course code | Course Name | Dept | Classification | | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|
| 1 | CS607106 | Augmented Reality / Virtual Reality | CSE | IE | Theory | 3 | 0 | 0 | 3 |
| 2 | CS607107 | Robotic Process Automation | CSE | IE | Theory | 3 | 0 | 0 | 3 |

**INSTITUTE ELECTIVE II**

| S.No | Course code | Course Name | Dept | Classification | | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|
| 1 | CS607205 | Neural Networks and Deep Learning | CSE | IE | Theory | 3 | 0 | 0 | 3 |
| 2 | CS607206 | Cyber security | CSE | IE | Theory | 3 | 0 | 0 | 3 |

**INSTITUTE ELECTIVE III**

| S.No | Course code | Course Name | Dept | Classification | | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|
| 1 | CS607305 | Front End Development | CSE | IE | Theory | 3 | 0 | 0 | 3 |
| 2 | CS607306 | Block Chain Architecture | CSE | IE | Theory | 3 | 0 | 0 | 3 |
| 3 | CS607307 | Optimization Techniques | CSE | IE | Theory | 3 | 0 | 0 | 3 |

**INSTITUTE ELECTIVE IV**

| S.No | Course code | Course Name | Dept | Classification | | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|
| 1 | CS607404 | Decision Making Methods | CSE | IE | Theory | 3 | 0 | 0 | 3 |
| 2 | CS607405 | Web Design And Development | CSE | IE | Theory | 3 | 0 | 0 | 3 |
| 3 | CS607406 | JAVA Programming | CSE | IE | Theory | 3 | 0 | 0 | 3 |

# SEMESTER I

| Course Code | PROFESSIONAL ENGLISH - I | L | T | P | C |
|---|---|---|---|---|---|
| IC610001 | | 2 | 0 | 0 | 2 |
| **Course Category:** *Industrial Core* | **Course Type:** *Theory* | | | | |

**Course Objective(s):**

The objective of this course is to make the learners to communicate effectively and appropriately in real life situation. It helps to improve the student's vocabulary and to develop strong conversation and role play skills. It will make them to grasp the substance and central idea from their communication skills.

**Course Outcomes: (COs)**

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

| | |
|---|---|
| **CO 1** | Write and speak clearly, read perceptively and think critically. |
| **CO 2** | Understand the correct usage of English grammar in writing and speaking. |
| **CO 3** | Write academic papers, essays and summaries using the process approach. |
| **CO4** | Read fluently through extensive reading. |
| **CO 5** | **S**peak in English both in terms of fluency and comprehensibility. |

**UNIT I - INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 6**

Technical English: Definition, Interpersonal, Intrapersonal, Verbal and Non-Verbal Communication. Speaking: Self-Introduction; Introducing a friend; Conversation – politeness strategies; Telephone Conversation. Reading: Reading longer technical texts. Writing: Paragraph writing Short Report on an event (fieldtrip etc.).

UNIT II - GRAMMATICAL COMPONENTS 6

Subject-Verb Agreement; Correct Usage: Noun; Pronoun; Modifiers; Articles; Prepositions; Prefixes and Suffixes, One Word Substations, Relative Pronouns, Sentence Structures, Phrase & Clause, Words and Phrases.

UNIT III - FORMS OF TECHNICAL WRITING 6

Letters: Complaint Letter, Placing an Order, Quotation, Enquiry letter, Agenda, Minutes of Meeting, Letter to the Editor, Technical Proposal: Writing of Proposal.

UNIT IV - FORMS OF TECHNICAL READING 6

Developing Efficient Reading Skills - Types- Skimming, Scanning, Extensive reading, Intensive reading – predicting content – Interpretation – Inference from text - Implications- Critical reading, reading technical articles, advertisements and editorial of newspaper.

**UNIT V - PRESENTATION STRATEGIES** **6**

Defining purpose, Audience & Locale, Organizing Contents, Preparing Audio-Video Aids, Body Language, Intonation: Stress & Rhythm, Presentation Techniques, Oral Presentation.

TEXT BOOKS:

1. Lakshminarayan K. R, Murugavel. T. Managing Soft skills, New Delhi SCITECH Publication, (India) Pvt Ltd.,2010.
2. Ried Alison. Spoken English. Goodwill publishing house; First edition. 2019.
3. V.N.Arora and Laxmi Chandra, Improve Your Writing. Oxford Univ.Press, New Delhi. 2013.
4. Carnegie Dale, The Quick and easy way to Effective Listening. Rupa; First edition. 2016.

REFERENCES:

1. Business Correspondence and Report Writing by Prof.R.C.Sharma & Krishna Mohan,TataMcGraw Hill & Co. Ltd., New Delhi. 2017.
2. Word Power Made Easy by Norman Lewis, W.R.Goyal Pub & Distributors; Delhi. Marcg 2015.

**WEB REFERENCES:**

1. **https://www.education.com/resources/grammar/**
2. **https://literacyideas.com**
3. **https://www.readingrockets.org**
4. **https://eslgold.com**
5. **https://basicenglishspeaking.com**

**CO PO MAPPING:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 1 | 2 | 1 | | | | 2 | | 2 | 2 | | 3 |
| **CO2** | 2 | 2 | 1 | | | | 2 | | 2 | 2 | | 3 |
| **CO3** | 2 | 2 | 2 | | | | 2 | | 2 | 2 | | 3 |
| **CO4** | 2 | 2 | 1 | | | | 2 | | 2 | 2 | | 3 |
| **CO5** | 1 | 1 | 1 | | | | 1 | | 1 | 1 | | 3 |

| Course Code | MATRICES AND CALCULUS | L | T | P | C |
|---|---|---|---|---|---|
| IC610002 | | 2 | 1 | 0 | 3 |
| Course Category: *Industrial Core* | Course Type:*Theory* | | | | |

**Course Objective(s):**

The objective of this course is to familiarize the students with basic elements of mathematics. It acquaints the students with standard concepts and tools that will serve as building blocks towards tackling more advanced level of mathematics that they are likely to find useful in their profession when employed in the firm/industry/corporation in public or private sector. This is specially designed for students to help them bring to speed with other students who have already had some training in mathematics at the higher secondary level.

**Course Outcomes: (COs)**

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

| | |
|---|---|
| **CO 1:** | Find the Eigen values, Eigen vectors, canonical form and nature of the quadratic form by matrix method. |
| **CO 2:** | Apply ordinary differentiation in maxima and minima and to Solve ordinary differential equations by various methods. |
| **CO 3:** | Find the Jacobian and application of Partial differential equations in Lagrange's method to find maxima and minima |
| **CO 4:** | Apply the concepts of integration and applications of indefinite integral by single Integration. |
| **CO 5:** | Use the change of variables in multiple Integration. |

**UNIT I - MATRICES** **12**

Matrices – Types of Matrices and operation including elementary row and column operation – Determinants (rules of computation) - Cayley-Hamilton theorem – Finding Inverse of a matrix using Cayley - Hamilton theorem – Eigen values and Eigen vectors – Diagonalization of matrix by Orthogonal transformation – Reduction of quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

Applications: Stretching of an elastic membrane and electrical networks.

**UNIT II - DIFFERENTIAL CALCULUS** **12**

Limits and Continuity – Concept of a derivative – Standard rules of differentiation – elementary trigonometric, logarithmic, and exponential differentiation – Implicit function differentiation – Taylors series expansion - Maxima and Minima for one variable.

Application: Maxima and Minima of one variable.

**UNIT III - FUNCTIONS OF SEVERAL VARIABLES** **12**

Partial differentiation – Homogenous functions – Euler's theorem – chain rule - Total derivatives – change of variable – Jacobians– Properties of Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables.

Applications: Maxima and Minima of functions of two variables and Lagrange's method of undetermined multipliers.

**UNIT IV - INTEGRAL CALCULUS** **12**

Integration – definite and indefinite integral – standard rules of Integration –Integration by parts – Trigonometric integrals, inverse, Trigonometric substitution – Integration of rational function by partial fraction – Improper Integrals.
Applications: Moments and Centers of mass.

**UNIT V- MULTIPLE INTEGRALS** **12**

Double Integration - Change of order of Integration – Area enclosed by plane curves – Triple Integrals – Volume of Solids – Change of variables in double and triple Integrals.
Applications: Moments and Centers of mass, Moment of inertia.

**TEXT BOOKS**:


1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi,2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, "Calculus: Early Transcendental", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV – Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 – 7.4 and 7.8].

**REFERENCES:**


1. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", NarosaPublications NewDelhi. 5th Edition, 2016.
3. Narayanan. S. and Manicavachagom Pillai. T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
4. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.


**WEB RESOURCES:**

1. https://www.matrixres.com/en
2. https://www.youtube.com/watch?v=dksu5SZZ80A
3. https://www.youtube.com/watch?v=nfx0pdwsrLI
4. https://www.youtube.com/watch?v=kfv9h3c46CI
5. https://www.youtube.com/watch?v=gQ-u_HlSKNk

| Course Code | ENGINEERING PHYSICS | L | T | P | C |
|---|---|---|---|---|---|
| IC610003 | | 3 | 0 | 0 | 3 |
| Course Category: *Industrial Core* | Course Type:*Theory* | | | | |

**Course Objective(s):**

To impart a strong foundation in the principles of Physics and make the students to apply them for engineering problems.

**Course Outcomes: (COs)**

At the end of the Course the students will be able to

| | |
|---|---|
| **CO 1** | Apply and gain the knowledge to explain the elastic properties of matter. |
| **CO 2** | Understand the knowledge on thermal conductivity of the materials and its significance. |
| **CO 3** | Understand the basics of electrostatics, current electricity and the production of electromagnetic waves. |
| **CO 4** | Understand the basic concept in quantum mechanics. |
| **CO 5** | Understand the fundamental concepts of Optics and Laser for engineering applications |

**UNIT I - ELASTIC PROPERTIES OF MATTER 9**

Elasticity – Hooke's law – stress-strain diagram – elastic modulus – Poisson's ratio – torsional stress and deformations – twisting couple; applications: Torsion pendulum (theory and experiment) – bending of beams – bending moment – cantilever – determination of Young's modulus by uniform and non-uniform bending (qualitative).

**UNIT II – THERMAL PHYSICS 9**

Heat Transfer -Conduction, Convection and Radiation(qualitative), Kinetic Theory of gases – distribution of velocities: Maxwell-Boltzmann law of distribution of velocities in an ideal gas, Mean, RMS and most probable speeds; degrees of freedom, Law ofequipartition of energy (No proof required), Specific heats of gases; Thermal conductivity and diffusion, application: Lee's Disc method (Theory and experiment) - Brownian motion and its significance.Introduction to thermo-electricity – Seebeck Effect, Peltier Effect, Thermoelectric devices, Thermistor, Newton's law of cooling.

**UNIT III - ELECTROMAGNETISM 9**

Coulomb's Law, Forces between charges, Electric field, Non-steady currents and charges, Faraday's laws of electromagnetic induction, concept of dipole, Ampere's circuital law, current loop as a dipole, torque on a dipole, Maxwell's field equations (derivation), Equation of continuity, displacement current. Electromagnetic wave equation (Derivation), Properties of plane electromagnetic waves: Poynting vector (derivation), production of electromagnetic waves, Applications: Hertz experiment.

**UNIT IV QUANTUM MECHANICS** **9**

Concept of de Broglie's Matter waves – Derivation of wavelength of matter waves in different forms– Heisenberg's Uncertainty principle, Concept of Phase velocity and Group velocity (qualitative); Schrodinger's Time independent and dependent equation (derivation),

Applications: Schrodinger's equation (qualitative treatment) – a) Particle in one dimensional rigid box b) Potential Barrier.

**UNIT V LASERS AND FIBRE OPTICS** **9**

Laser and its characteristics, Einstein's Coefficients (derivation), population inversion, meta stable state, types of pumping, lasing action, construction and working of He-Ne laser, $CO_2$ laser, Nd-YAG laser – Applications. Introduction to optical fiber, construction and working principle of an optical fiber, acceptance angle and numerical aperture, types of optical fibers – mode and propagation through step and graded index fibers, attenuation, Engineering, industrial and medical applications of optical fiber.

**TEXT BOOKS:**


1. R.K. Gaur and S. L. Gupta, Engineering Physics (2009)DhanbatRai Publication
2. E. Clark, Physics Electricity Magnetism& Waves, CBS Publishers & Distributors (2005).
3. R. Murugeshan and KiruthikaSivaprasath, Modern Physics, S. Chand Publishers, 18th Edition(2019)


**REFERENCE BOOKS:**


1. Arthur Beiser, Shobit Mahajan and S. Rai Choudhury, Concepts of Modern Physics, 7thedition,McGraw Hill (2017)
2. D.K. BhattacharyaPoonamTandon, Engineering physics, Oxford University Press (2015)
3. DattuprasadRamanlal Joshi, Engineering Physics, Tata McGraw Hill Education Private Limited, (2010).
4. B N Sankar, S O Pillai, Engineering Physics**,New Age International private limited,(2015)**


| **Course Outcomes** | **Program Outcomes** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO 12** |
| **CO 1** | 3 | 2 | 2 | | | | | 2 | | | 3 | 2 |
| **CO 2** | 3 | 2 | 2 | 1 | | | | | | | | 2 |
| **CO 3** | 3 | 2 | 2 | 1 | | | | | | | | 2 |
| **CO 4** | 3 | 2 | 2 | 1 | | | | 2 | | | 2 | 2 |
| **CO 5** | 3 | 2 | 2 | 1 | | | | 2 | | | | 2 |

| Course Code | ENGINEERING CHEMISTRY | L | T | P | C |
|---|---|---|---|---|---|
| IC610004 | | 3 | 0 | 0 | 3 |
| Course Category: *Industrial Core* | Course Type:*Theory* | | | | |

Course Objective(s):

To impart a strong foundation in the principles of chemistry and make the students to apply them for engineering problems.

**Course Outcomes: (COs)**

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

| | |
|---|---|
| **CO 1** | Apply the knowledge in chemical industries in the manufacture of chemicals. |
| **CO 2** | Differentiate the various sources of energy and its applications. |
| **CO 3** | Understand about corrosion and its protection techniques. |
| **CO 4** | Knowusage of analytical devices for industrial processes. |
| **CO 5** | Understand the basic concepts of phase rule in the manufacture of alloys and its applications. |

**UNIT I - INDUSTRIAL CHEMICALS 9**

Introduction – Preparation and industrial applications of ammonium chloride, ammonium nitrate, ammonium sulfate, chromic acid, acrylonitrile, caprolactam, cellulose acetate, diethyl ether, glycerin, melamine (from urea). Rocket propellants: Definition, characteristics of good propellants, classification and advantages of propellants.

**UNIT II - ENERGY SCIENCES 9**

Battery technology – Fundamentals of primary cells, rechargeable batteries, Ni-Cd battery, $Ag_2O$-Zn alkaline battery, lead-acid storage cells; Fuel cells – hydrogen–oxygen fuel cell, Solid oxide fuel cells (SOFC): principles, applications, advantages/disadvantages. Conventional Fuels – Types of fuels, calorific value, processing and refining of petroleum, liquid fuels - synthesis of petrol by Bergius process - Knocking and anti-knocking agents, Octane and Cetane values, cracking of crude oil - catalytic cracking, Nuclear Energy - nuclear reactor – working principle (conventional energy), Non - conventional sources of energy: Solar energy (principles), Wind energy- Applications

**UNIT III - CORROSION 9**

Definition, dry (or chemical) corrosion, wet (or electrochemical) corrosion and their mechanisms; Types of electrochemical corrosion, (differential aeration, galvanic). Typical electrochemical corrosion like pitting, inter-granular, soil, and waterline corrosion. Factors affecting corrosion. Protection of corrosion – Sacrificial Anodic Protection (SAP) method and Impressed Current Cathodic Protection method (ICCP). Protective coatings – Paints: constituents and function.

**UNIT IV - INSTRUMENTAL TECHNIQUES 9**

Beer-Lambert's law–Flame photometry – principle – instrumentation (block diagram only) – Estimation of sodium by flame photometry – Atomic Absorption Spectroscopy (AAS) – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy. Thermal methods of analysis: Thermogravimetric analysis (TGA) - principles, instrumentation (block diagram only), application of TGA to decomposition of calcium oxalate system, Differential thermal analysis (DTA) - principles, instrumentation (block diagram only), endothermic curves,exothermic curves, DTA thermogram analysis of pure sulfur.

**UNIT V - PHASE RULE AND ALLOYS 9**

Phase Rule: Phase, component, degree of freedom, phase rule applications to one component system-water system. Condensed phase rule, two component system: lead-silver system. Alloys: Importance of making alloys, types of alloys: ferrous and nonferrous alloys. Nichrome, carbon steel, duralumin, monel metal. Powder metallurgy, Heat treatment of alloys.

**TEXT BOOKS:**


1. Vairam and Suba Ramesh, Engineering Chemistry-I, Wiley India Pvt. Ltd, 2014.
2. Shashi Chawla, A Text Book of Engineering Chemistry, Dhanpat Rai & Co., 2015.
3. C. V. Agarwal, C. P. Murthy, A. Naidu, "Chemistry of Engineering Materials", Wiley India, 5th Edition, 2013.
4. Engineering Chemistry by Prasanth Rath, Cengage Learning, 2015 edition.


**REFERENCES:**


1.Puri, Sharma, Pathania, *Principles of Physical Chemistry*, Vishal Publishing Co.,2015.

2. B. Siva Shankar, "Engineering Chemistry", Tata Mc Graw Hill Publishing Limited, 3rd Edition, 2015.

3.P.Mani,K.N.Mishra,"Chemistryof Engineering Materials", Cengage Learning,3rdEdition, 2015.


**WEB REFERENCES:**

1. https://www.studocu.com/in/document/sardar-patel-university/industrial chemistry/industrial-chemistry-lecture-notes-1-18/20483178.
2. http://www.freebookcentre.net/chemical-books-download/Energy-Engineering-Lecture-Notes.html
3. https://www.lkouniv.ac.in/site/writereaddata/siteContent/202003251903229434ranvijay_Corrosion_Science.pdf
4. https://www.sathyabama.ac.in/sites/default/files/course-material/2020-10/SCY2.pdf
5. https://ccsuniversity.ac.in/bridge-library/pdf/Engg-AG-Engg-Chem-2nd-sem-subodh-Lecture-5.pdf

**CO PO MAPPING:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO 1** | 3 | 2 | 2 | 1 | | | 3 | | | | 2 | 2 |
| **CO 2** | 3 | 2 | 2 | 1 | | | 3 | | | | | 2 |
| **CO 3** | 3 | 2 | 2 | 1 | | | 3 | | | | | 2 |

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

| Course Code | PROBLEM SOLVING AND 'C' PROGRAMMING | L | T | P | C |
|---|---|---|---|---|---|
| CS610005 | | 3 | 0 | 0 | 3 |
| **Course Category:** *Industrial Core* | **Course Type:** *Theory* | | | | |

Course Objective(s):

1.To understand the basics of algorithmic problem solving.
2. To develop C Programs using basic programming constructs
3. To develop C programs using arrays and strings.
4. To develop modular applications in C using functions and pointers
**5.** To develop applications in C using structures and union

**Course Outcomes: (COs)**

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

| | |
|---|---|
| **CO 1** | Develop algorithmic solutions to simple computational problems. |
| **CO 2** | Develop simple applications in C using basic constructs. |
| **CO 3** | Design and implement applications using arrays and strings. |
| **CO 4** | Develop and implement modular applications in C using functions and pointers. |
| **CO 5** | Develop applications in C using structures and union. |

**UNIT I - COMPUTATIONAL THINKING AND PROBLEM SOLVING 9**

Software and its types – Software Life Cycle - Algorithm and Flowchart for problem solving with Sequential Logic Structure, Decisions and Loops. Imperative languages: Introduction to imperative language; syntax and constructs of a specific language (ANSI C).

**UNIT II - BASICS OF C PROGRAMMING 9**

Introduction to programming paradigms – Applications of C Language - Structure of C program - C programming: Data Types - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements-Assignment statements – Decision making statements - Switch statement - Looping statements – Preprocessor directives - Compilation process.

**UNIT III - ARRAYS AND STRINGS 9**

Introduction to Arrays: Declaration, Initialization – One dimensional array – Two dimensional arrays - String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.

**UNIT IV - FUNCTIONS AND POINTERS 9**

Functions- Defining function- Accessing a function- Function prototypes- Passing arguments to a functions- Passing arrays to a function- Passing Pointers to function- Recursion – Dynamic memory allocation - malloc, calloc, realloc-Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers..

.**UNIT V - STRUCTURES AND UNION 9**

Structures – Declaration –Nested Structures- Structures and Functions – Arrays of Structures – Pointers to structures – Typedef - Unions – Bit-fields.

Case Studies:

1. Print Characters without using format specifiers
2. Check the given IP address is valid or not
3. Storage management using Structure and Union

**TEXT BOOKS:**


1. Allen B. Downey, “Think Python: How to Think like a Computer Scientist”, 2nd Edition, O’Reilly Publishers, 2016.
2. Karl Beecher, “Computational Thinking: A Beginner's Guide to Problem Solving and programming”, 1st Edition, BCS Learning & Development Limited, 2017.
3. ReemaThareja, “Programming in C”, Oxford University Press, Second Edition, 2016.
4. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2015.


**REFERENCES:**


2. Paul Deitel and Harvey Deitel, “C How to Program with an Introduction to C++”, Eighth edition, Pearson Education, 2018.
3. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers and Data Scientists”, 1st Edition, Notion Press, 2021.
4. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data‘‘, Third Edition, MIT Press.2021
5. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
6. Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, Second Edition, Oxford University Press, 2013.
7. Byron S. Gottfried, “Schaum’s Outline of Theory and Problems of Programming with C”, McGraw-Hill Education, 1996.
8. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, 1st Edition, Pearson Education, 2013.

**WEB REFERENCES:**

1. https://www.youtube.com/watch?v=reUOojtbU3A
2. https://www.youtube.com/watch?v=3QiItmIWmOM
3. https://www.youtube.com/watch?v=3ZgDx-0oGQQ
4. https://www.youtube.com/watch?v=qaszuaFXRTA
5. https://www.youtube.com/watch?v=jjNs_x7rlQk

**CO PO MAPPING:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO 1** | 3 | | | | | | | | | | | |
| **CO 2** | 3 | 2 | | | | | | | | | | |
| **CO 3** | | 2 | 3 | | 3 | | | | | | | |
| **CO 4** | | 2 | 3 | | 3 | | | | | | | 2 |
| **CO 5** | | 2 | 3 | 3 | | | | | | | | 2 |

| Course Code | ENGINEERING GRAPHICS WITH CAD | L | T | P | C |
|---|---|---|---|---|---|
| ME610006 | | 2 | 0 | 2 | 3 |
| Course Category: *Industrial Core* | Course Type:*Theory* | | | | |

Course Objective(s):

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

**Course Outcomes: (COs)**

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

| | |
|---|---|
| **CO 1** | Illustrate the fundamentals of engineering drawing and draw orthographic projections of points and lines. |
| **CO 2** | Draw the orthographic projections of planes and simple solids. |
| **CO 3** | Draw the orthographic projections of sectioned solid and development of surfaces. |
| **CO 4** | Sketch the isometric view of simple solids. |
| **CO 5** | Determine to determine the features of CAD Software |

**CONCEPTS AND CONVENTIONS** (Not for Examination) **2**

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

**UNIT I- ORTHOGRAPHIC PROJECTION 12**

Introduction to orthographic projection, drawing orthographic views of objects from their isometric views. Orthographic projections of points lying in four quadrants. Orthographic projection of lines parallel and inclined to one and both the planes.

**UNIT II-PROJECTION OF PLANES AND SOLIDS 12**

Orthographic projection of planes inclined to any one of the plane.

Projections of simple solids - axis perpendicular to HP, axis perpendicular to VP and axis inclined to horizontal planes only.

**UNITIII-PROJECTIONOFSECTIONEDSOLIDS& DEVELOPMENT OF SURFACES 12**

Introduction to sectioning of solids - Section planes perpendicular to one plane and parallel to

another plane, section plane inclined to horizontal plane.

Introduction to development of surfaces - Development of prisms, pyramids and cylindrical & conical surfaces.

**UNIT IV- ISOMETRIC PROJECTION 12**

Introduction to Isometric projection and isometric views of different planes and simple solids - Introduction to perspective projection.

**UNIT V INTRODUCTION TO COMPUTER AIDED DRAFTING 10**

Computer screen, layout of the software, standard tool bar / menu and description of most commonly used tool bars, and navigational tools.

Co-ordinate system and reference planes HP, VP, RPP & LPP of 2D/3D environment. Selection of drawing sheet size and scale.

Commands and creation of Lines, coordinate points, axes, poly-lines, square, rectangle, polygons, circle, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz., tangency, parallelism, inclination and perpendicularity.

**TEXT BOOK:**


1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House 53rd Edition, 2019.
2. Natrajan K.V., “A Text Book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2018.


**REFERENCES:**


1. Basant Agarwal and Agarwal C.M.,“Engineering Drawing”, McGraw Hill, 2nd Edition, 2019.
2. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Publications, Bangalore, 27thEdition, 2017.
3. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson Education India, 2nd Edition, 2009.
4. Venugopal K. and Prabhu Raja V., “Engineering Graphics", New Age International Publishers; Fifteenth edition (1 July 2018)


**WEB RESOURCES:**

1. https://www.youtube.com/watch?v=ANEvQyt3PnU
2. https://www.youtube.com/watch?v=-W7tH49dBLw&t=36s

**CO -PO MAPPING:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO 1** | 3 | 3 | 2 | | | | | | | | | 2 |
| **CO 2** | 3 | 2 | 2 | | | | | | | | | 2 |
| **CO 3** | 3 | 3 | 2 | | | | | | | | | 2 |
| **CO 4** | 3 | 3 | 3 | | | | | | | | | 2 |
| **CO 5** | 3 | 3 | 3 | | 3 | | | | | | | 2 |

| Course Code | PHYSICS & CHEMISTRY LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| IP610101 | | 0 | 0 | 3 | 1.5 |
| | Course Type: *Practical* | | | | |

## PHYSICS LABORATORY

Course Objective(s):

To familiarize the student's knowledge about fundamentals of physics and train them to handle the instruments.

**Course Outcomes: (COs)**

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

| | |
|---|---|
| **CO 1** | Measure the Wavelength of laser light |
| **CO 2** | Study the properties of ultrasonic waves |
| **CO 3** | Find the mechanical properties of materials |
| **CO 4** | Analyse the thermal properties of materials |
| **CO 5** | Find the magnetic properties of matereials |

**LIST OF EXPERIMENTS IN PHYSICS**

1. Laser parameter, particle size and acceptance angle
2. Velocity of ultrasonic waves – Ultrasonic Interferometer
3. Young's Modulus of the material – Uniform and Non-Uniform bending
4. Thermal conductivity of bad conductor – Lee's disc method
5. Hysteresis – Magnetometer method
6. Bandgap determination of a semiconductor – P.O Box Method

**CO PO MAPPING:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO 1** | 3 | 1 | 2 | | | 2 | | | 3 | | | 2 |
| **CO 2** | 3 | 1 | 2 | | | 2 | | | 3 | | | 2 |
| **CO 3** | 3 | 1 | 2 | | | 2 | | | 3 | | | 2 |
| **CO 4** | 3 | 1 | 2 | | | 2 | | | 3 | | | 2 |
| **CO 5** | 3 | 1 | 2 | | | 2 | | | 3 | | | 2 |

## CHEMISTRY LABORATORY

Course Objective(s):

To familiarize the student's knowledge about fundamentals of chemistry and train them to handle the chemicals.

**Course Outcomes: (COs)**

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

| | |
|---|---|
| **CO 1** | Estimate the amount of total hardness in the given sample of hard water by EDTA method. |
| **CO 2** | Estimate the carbonate and non-carbonate hardness in the given sample of hard water byEDTA method. |
| **CO 3** | Determine the amount of dissolved oxygen in the given water sample by winklers method. |
| **CO 4** | Determine the amount of dissolved oxygen in the given water sample by winklers method. |
| **CO 5** | Determine the amount of barium chloride present in the given solution by conductometric |

**LIST OF EXPERIMENTS IN CHEMISTRY**

1. Determination of total hardness in water sample using EDTA.
2. Estimation of carbonate and non-carbonate hardness of water.
3. Determination of Dissolved Oxygen in Water
4. Conductometric Precipitation Titration.
5. Potentiometric Titration (Redox).
6. Estimation of copper in brass by EDTA method.

**CO-PO MAPPING:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO 1** | 3 | 2 | 2 | | | | 1 | | 3 | | | 2 |
| **CO 2** | 3 | 2 | 2 | | | | 1 | | 3 | | | 2 |
| **CO 3** | 3 | 2 | 2 | | | | 1 | | 3 | | | 2 |
| **CO 4** | 3 | 2 | 2 | | | | 1 | | 3 | | | 2 |
| **CO 5** | 3 | 2 | 2 | | | | 1 | | 3 | | | 2 |

| Course Code | PROGRAMMING IN 'C' LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| IP610102 | | 0 | 0 | 3 | 1.5 |
| | **Course Type:** ***Practical*** | | | | |

Course Objective(s):

1.To learn and execute the simple programs in C' language
2.To be familiar with looping and branching concepts in C' Programming
3.To be familiar with array in C' Programming
4.To learn the concept of functions in C' Language
5.To study about the concept of Structures and Unions

**Course Outcomes: (COs)**

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

| | |
|---|---|
| **CO 1** | Solve simple problems using C' Language. |
| **CO 2** | Execute the programs using control statements. |
| **CO 3** | Handle arrays in C' Programs. |
| **CO 4** | Write functions and to solve some complicated problems in C. |
| **CO 5** | Handle structure and unions in C' Programs. |

**LIST OF EXPERIMENTS**

1. Write a 'C' Program to generate first 'n' terms of the Fibonacci sequence
2. Write a 'C' Program to generate prime numbers between 1 and 'n'
3. Write a 'C' Program to find the Factorial using recursion and non-recursion
4. Write a 'C' Program to find the GCD of two given positive numbers
5. Write a 'C' Program to perform the arithmetic operations on two numbers using switch statement
6. Write a 'C' Program to find the sum of series ($1-x^2/2! +x^4/4!-x^6/6!+x^8/8!-x^{10}/10!$)
7. Write a 'C' Program to implement the addition of 'n' numbers in an array
8. Write a'C' program to find both the largest and smallest number in a list of integers after arranging them in ascending order
9. Write a 'C' Program to merge two sorted arrays
10. Write a 'C' Program to find the given string is Palindrome or not.
11. Write a 'C' program to find string handling mechanism
12. Write a 'C' Program that uses the concept of function
13. Write a 'C' program to calculate an array of pointers.
14. Write a 'C' program to read and print an employee's details using structure
15. Write a 'C' program to find size of the union

**Hardware / Software Required for a Batch of 30 Students**
**Hardware**

- Standalone PCs – 30 Nos.

**Software**

- Operating System – Windows
- Compiler – C

## CO PO MAPPING:

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO 1** | 3 | | | | | | | | | | | |
| **CO 2** | 3 | 2 | | | | | | | | | | |
| **CO 3** | | 2 | 3 | | | | | | | | | |
| **CO 4** | | 2 | 3 | | | | | | | | | 2 |
| **CO 5** | | 2 | 3 | 3 | | | | | | | | 2 |

# INSTITUTE MANDATORY COURSE

## NATIONAL CADET CORPS(NCC)/NATIONAL SERVICESCHEME (NSS)/NATIONAL SPORTSORGANIZATION (NSO)

Course Objective(s):

To enable the students to gain knowledge about NCC/NSS/NSO and put the same into practice

**Course Outcomes: (COs)**

At the end of this course, the students will be able to Imbibe in their minds related to the concepts and benefits of NCC/NSS/NSO and make them practice the same.

**NATIONAL CADET CORPS (NCC):**

Any student enrolling as a member of National Cadet Core (NCC)will have to attend sixteen parades out of twenty parades each offour periods over a span of academic year.Attending eight parades in first semester will qualify a student toearn the credits specified in the curriculum. Grading shall be done based on punctuality, regularity in attending the parades and theextent of active involvement.

**NATIONAL SERVICE SCHEME (NSS):**

A student enrolling as member of NSS will have to complete 60hours of training / social service to be eligible to earn the creditsspecified in the curriculum.Grading shall be done by the faculty member handling the course based on punctuality, regularity in attending the classes and theextent of active involvement.

**NATIONAL SPORTS ORGANIZATION (NSO):**

Each student must select one of the following games/sports eventsand practice for one hour per week. An attendance of 75% iscompulsory to earn the credits specified in the curriculum. Gradingshall be done by the faculty member handling the course based on punctuality, regularity in attending the classes and the extent of active involvement. List of games/sports:Basket Ball, Football, Volley Ball, Ball Badminton, Cricket, Throw- ball, Track events, Field events or any other game with the approval of faculty member.

# SEMESTER II

| Course Code | PROFESSIONAL ENGLISH II | L | T | P | C |
|---|---|---|---|---|---|
| IC620008 | | 2 | 0 | 2 | 3 |
| **Course Category:** *Industrial Core* | **Course Type:***Theory* | | | | |

Course Objective(s):

The objective of the course is to make the students to possess the basic workplace skills. It makes the students to empower the learners of Engineering and Technology to attain the key employability skills.

**Course Outcomes: (COs)**

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

| | |
|---|---|
| **CO 1** | Improve their employability skills and to develop their competence and competitiveness. |
| **CO 2** | Solve the problems in communicative contexts using analytical thinking skills. |
| **CO 3** | Create formal reports and proposals cohesively, creatively and flawlessly. |
| **CO 4** | Think in innovative ways to solve issues in the work place by enhancing the creativity of the students. |
| **CO 5** | Improve their competence in the use of English with particular reference to the workplace situations. |

**UNIT I - MAKING COMPARISONS** **6**

**Listening:** Listening and Responding to complaints, Listening to problem, Evaluating listening: Advertisement, Product/Description, Listening and Filling a form. **Speaking:** Offering solution, Group Discussion **Reading:** Reading aloud, Reading Advertisements, User Manuals. **Writing:** Professional Emails, Writing a paragraph on Motivational ideas.

**UNIT II - PERSUASIVE COMMUNICATION** **6**

**Listening:** Listening to famous speeches, Listening to a product launch, Watching movie scenes or documentaries, Depicting a technical problem. **Speaking:** Making a Short Speeches- Formal: Welcome Speech and Vote of Thanks, Informal: Farewell Speech, Graduation Speech. **Reading:** Stress and Intonation-Voice Modulation. **Writing:** Dialogue writing, writing opinion pieces (book review, Food review, Film review).

**UNIT III - DIGITAL COMPETENCE** **6**

**Listening:** Listening to Interview, Gap Filling exercises, Listening to Panel Discussions. **Speaking:** Interview with subject specialists, participating in a meeting: Face to Face and Online, Creating Vlogs (subject related). **Reading:** Excerpts from literary Texts, News Reports, **Writing:** Preparing first draft of short assignments, Checklists.

**UNIT IV - CREATIVITY AND IMAGINATION** **6**

**Listening:** Listening comparison based on news reports, Documentaries. **Speaking:** Interviewing, Presenting on Oral Report, Mini presentation on selected topics. **Reading**: Essays on creativity and imagination (subject based). **Writing:** Recommendation, Reports and Technical and Scientific Articles.

**UNIT V - WORKPLACE COMMUNICATION AND BASIC ACADEMIC WRITING**

**6**

**Listening:** Listening to the Presentation, Formal Job Interview, Informal Interview for feature writing, Short videos (conference meeting). **Speaking:** Short academic presentation using powerpoint presentation, Debate. **Reading:** Product profiles, Circulars, Scripts reading. **Writing:** Writing an introduction, Paraphrasing and Job Application: Cover Letter and Resume.

**TOTAL HOURS: 30**

**TEXT BOOKS:**

1. English for Engineers and Technologist (2020 edition). Orient Blackswan Pvt. Ltd, Department of English Anna University.
2. English for Science and Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadharshini, Dr. Deepa Mary Francis, Dr. KN. Sobha and Dr. Lourdes Joevani, Department of English Anna University.

**REFERENCE BOOKS:**

1. Raman, Meenatchi, Sharma. Sangeetha. Professional English. Oxford University press. New Delhi. 2019.
2. Communication skills for professionals and students by Dr. Amitabh Dwivedi, Notion Press, 1st Edition. 2019.

## WEB REFERENCES:

1. **https://literacyideas.com**
2. **https://www.readingrockets.org**
3. **https://eslgold.com**

**CO PO MAPPING:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 1 | 2 | 1 | | | | 2 | | 2 | 2 | | 3 |
| **CO2** | 2 | 2 | 1 | | | | 2 | | 2 | 2 | | 3 |
| **CO3** | 2 | 2 | 2 | | | | 2 | | 2 | 2 | | 3 |
| **CO4** | 2 | 2 | 1 | | | | 2 | | 2 | 2 | | 3 |
| **CO5** | 1 | 1 | 1 | | | | 1 | | 1 | 1 | | 3 |

| Course Code | TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS | L | T | P | C |
|---|---|---|---|---|---|
| IC620009 | | 2 | 1 | 0 | 3 |
| **Course Category:** *Industrial Core* | **Course Type:***Theory* | | | | |

Course Objective(s):

The objective of this course is to familiarize the students with basic elements of mathematics. It acquaints the students with standard concepts and tools that will serve as building blocks towards tackling more advanced level of mathematics portion in public or private sector. This is specially designed for students to help them bring to speed with other students who have already had some training in mathematics at the higher secondary level.

**Course Outcomes: (COs)**

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

| | |
|---|---|
| **CO 1** | Have a fundamental knowledge of the Fourier series. |
| **CO 2** | Apply PDE Engineering. |
| **CO 3** | Have a well-founded knowledge of Laplace transform which can describe real life phenomena. |
| **CO 4** | Have a fundamental knowledge of the Fourier transforms. |
| **CO 5** | Have a fundamental knowledge of the Z-Transforms |

**UNIT I - FOURIER SERIES** **12**

Fourier series – Dirichlet's conditions – General Fourier series –Fourier series of periodic functions with different periods - Fourier series of Odd functions – Fourier series of even functions – Half range Fourier sine series – Half range Fourier cosine series – Root mean square value - Parseval's identity – Harmonic Analysis

**UNIT II - PARTIAL DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS** **12**

Formation of partial differential equations – the four standard forms – Equations of the form f(p,q) = 0 – Clairaut's equation - Solution of Lagrange's linear partial differential equations Pp+Qq = R.

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction(Insulated edges excluded).

**UNIT III - LAPLACE TRANSFORM** **12**

Laplace transform – Conditions for existence – Transform of elementary functions –Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse functions – Transform of periodic functions. Definition of Inverse Laplace transform as contour integral – Convolution theorem(excluding proof) – Application of Laplace transformation.

**UNIT IV - FOURIER TRANSFORMS** **12**

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem– Parseval's identity- Application of Fourier transforms.

**UNIT V - Z -TRANSFORMS AND DIFFERENCE EQUATIONS** **12**

Z-transforms - Elementary properties – Inverse Z-transform – Convolution theorem -Formation of difference equations – Application of Z-transforms.

**TEXT BOOKS:**

1. Grewal, B.S, 'Higher Engineering Mathematics' 47th Edition, Khanna publishers Delhi, (2016)
2. Bali.N.P and Manish Goyal 'Transforms and partial differential Equations', Second Edition, Laxmi Publications(P) Ltd. (2011) (For units 2,3,4,5)

**REFERENCES:**

1. Ramana.B.V. 'Higher Engineering Mathematics' Tata Mc-GrawHill Publishing Company limited, New Delhi (2007).
2. Glyn James, 'Advanced Modern Engineering Mathematics', Third edition-Pearson Education (2007).
3. Erwin Kreyszig 'Advanced Engineering Mathematics', Eighth edition - Wiley India(2007).
4. T.Veerarajan, "Engineering Mathematics", Tata-Mc Graw Hill Publishing Pvt. Ltd., New Delhi (2008).

**WEB RESOURCES:**

1. https://blogs.ed.ac.uk/mnaylor/2020/10/13/web-resources-on-fourier-transforms/
2. https://www.youtube.com/watch?v=jo8EO2KxLmw
3. https://www.youtube.com/watch?v=KqokoYr_h1A
4. https://www.youtube.com/watch?v=3pBumhfj7MY
5. https://www.youtube.com/watch?v=CrhhKz3-9hI

## CO PO MAPPING:

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 3 | 2 | 2 | 1 | | | | | | | | 3 |
| **CO2** | 3 | 2 | 2 | 2 | | | | | | | | 3 |
| **CO3** | 3 | 2 | 2 | 2 | 1 | | | | | | | 3 |
| **CO4** | 3 | 2 | 2 | 2 | 1 | | | | | | | 3 |
| **CO5** | 3 | 2 | 2 | 2 | 1 | | | | | | | 3 |

| Course Code | ENGINEERING MATERIALS (for non circuit branches) | L | T | P | C |
|---|---|---|---|---|---|
| IC620010 | | 3 | 0 | 0 | 3 |
| **Course Category:** ***Industrial Core*** | **Course Type:*****Theory*** | | | | |

Course Objective(s):

To provide exposure and knowledge in the Physics of materials especially in engineering applications and to introduce the characterization of materials related to it.

**Course Outcomes: (COs)**

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

| | |
|---|---|
| **CO 1** | Apply the knowledge gained to identify crystal structures and synthesize crystals |
| **CO 2** | Equipe the knowledge on different types of electron theory and the basics of superconductors |
| **CO 3** | Understand to distinguish conductors, insulators and semiconductors; analyze and evaluate the performance of electronic devices. |
| **CO 4** | Familiarize the students with the theory and applications of magnetic materials and applications of nanotechnology |
| **CO 5** | Understand the fundamentals of composite and Bio materials. |

**UNIT I - SOLID STATE MATERIALS 9**

Crystal systems – classification - Simple cubic (SC), Body Centered cubic (BCC), Face centered cubic (FCC) - Atomic radius – Packing factor –polymorphism and allotropy–Nucleation: Homogeneous and heterogeneous; - Crystal growth: solution growth - Czochralski, Bridgman - Sol-gel; Applications: Bragg'slaw, Powder X-ray diffractometer.

**UNIT II - CONDUCTING AND SUPER CONDUCTING MATERIALS 9**

Electrons in a metal - Density of energy states – effect of temperature on Fermi energy – carrier concentration in metals: Hall Effect – determination of carrier concentration and mobility. Superconducting Phenomena, Properties of superconductors – Meissner effect and Isotope effect. Type I and Type II superconductors, High Tc superconductors; Applications: Magnetic levitation, Josephson Effect – SQUIDS, cryotron.

**UNIT III - SEMICONDUCTING AND ELECTRONIC MATERIALS 9**

Introduction, Energy and sin solids, band gap formation. Intrinsic semiconductors, Extrinsic semiconductors, carrier concentration and Fermi level variations (n type and p type) and conductivity. Metal- semiconductor junction– PN junction – PN junction under bias– Junctionbreakdown–heterojunction–transistorsandMOSFETs–Optoelectronicdevices;
Applications: LED, Laser, Photodetectors.

**UNIT IV - MAGNETIC MATERIALS AND NANO TECHNOLOGY 9**

Classification of magnetic materials: Dia, Para, ferro, Antiferro and ferrimagnetism–Hard and soft Magnetic materials, Weiss theory of ferromagnetism, Application: hysteresis, Nanoparticles

– Nanoclusters – Nanostructures – surface to volume ratio – size and dimensionalityeffects– carbonnanotubes–applicationsofcarbonnanotubes–quantumnanostructures–preparation of quantum nanostructures –applications of quantum nanostructures–photolithography– working principle of scanning electron microscope (SEM), tunneling electron microscope (TEM) and atomic for cemicroscopy (AFM).

**UNIT V - COMPOSITE MATERIALS 9**

Introduction and overview of composite materials and their need, Enhancement of properties, classification of composites, Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC), Application of composites.Recent developments in Composites: Self healing composites, Molecular composites, Micro and Nano composites, Bio composites, Left handed composites, Stiffer than stiff composites, Carbon / carbon composites (Advantages and limitations of carbon matrix)

**TEXT BOOKS:**


1. V.Raghavan, Materials science and Engineering: A First Course, (2015).
2. Kumar. J, MoorthyBabu. S and Vasudevan. S., Engineering Physics, Vijay Nicole Imprints, (2006).


**REFERENCES:**


1. Sergio M Resande, Introduction to Electronic Materials and Devices (e-book), Springer Link ,First Edition (2022).
2. Arthur Beiser, ShobitMahajan and S. RaiChoudhury, Concepts of Modern Physics, 7$^{th}$edition,McGraw Hill (2017)
3. Lev I.Berger ,Semiconductor Materials,(2020)
4. Dilip Kumar Roy,Electronics Materials and Semiconductor Devices ,(2013).
5. J.PingLiu,EricFullerton,OliverGutfleisch ,Nanoscale Magnetic Materials and Applications,(2022)

**WEB RESOURCES:**

1. https://physics.uiowa.edu/research/condensed-matter-and-materials-physics
2. https://www.cambridge.org/core/series/solid-state-materials/1152B348C4C7AF23BC28FC2535B9E2BA
3. https://physicstoday.scitation.org/doi/10.1063/PT.3.4751
4. https://www.iop.org/explore-physics/big-ideas-physics/nanotechnology2d-materials
5. https://physicsworld.com/a/materials-and-nanotechnology-highlights-of-2021/
6. https://www.nde-ed.org/Physics/Materials/Introduction/composites.xhtml
7. https://www.science.org.au/curious/technology-future/composite-materials

**CO-PO MAPPING:**

| **Course Outcomes** | **Program Outcomes** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO 1** | 3 | 2 | 2 | 1 | | | | | | | 3 | 3 |
| **CO 2** | 3 | 2 | 2 | 1 | | | | | | | | 3 |
| **CO 3** | 3 | 2 | 2 | 1 | | | | | | | | 3 |
| **CO 4** | 3 | 2 | 2 | 1 | | | | | | | | 3 |
| **CO 5** | 3 | 2 | 2 | 1 | | | | | | | 2 | 3 |

| Course Code | SEMI CONDUCTOR PHYSICS (for circuit branches) | L | T | P | C |
|---|---|---|---|---|---|
| IC620011 | | 3 | 0 | 0 | 3 |
| Course Category: *Industrial Core* | Course Type:*Theory* | | | | |

Course Objective(s):

To provide exposure and knowledge in the Semiconductor Physics for circuit branches.

**Course Outcomes: (COs)**

At the end of the Course the students will be able to,

| | |
|---|---|
| **CO 1** | Apply the knowledge gained to identify crystal structures and the significance of crystal effects. |
| **CO 2** | Differentiate the types of electronic materials and the origin of bands. |
| **CO 3** | Apply the sound knowledge gained on semiconductor Physics towards optoelectronic devices |
| **CO 4** | Understand the various measurement techniques for engineering applications |
| **CO 5** | Understand the working parameters of a solar cell and the technologies that are used to harness the power of solar energy |

**UNIT I – CRYSTAL STRUCTURE** **9**

Crystal– classification-calculation of number of atoms per unit cell–atomic radius coordination number– packing factor for simple cubic (SC), Body Centered cubic(BCC), Face centered cubic (FCC) and Hexagonal closed packed(HCP)structures –polymorphism and allotropy–crystal defects: point, line and surface defects; Applications: Bragg's law, Powder X-ray diffractometer.

**UNIT II - ELECTRONIC MATERIALS** ` **9**

Free electron theory, Density of states and energy band diagrams, Kronig-Penny model to introduce origin of band gap, Energy bands in solids, E-k diagram, Direct and indirect bandgaps, Types of electronic materials: metals, semiconductors, and insulators, Occupation probability, Fermi level, Effective mass, Phonons.

**UNIT III – SEMICONDUCTORS** **9**

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for optoelectronic devices: transistors and MOSFETs– LED, Laser, Photodetectors.

**UNIT IV - MEASUREMENTS & ENGINEERED SEMICONDUCTOR MATERIALS 9**

Four-point probe and van der Pauw measurements for carrier density, resistivity, and hall mobility; Hot-point probe measurement, capacitance-voltage measurements, parameter extraction from diode I-V characteristics, Deep Level Transient Spectroscopy (DLTS), band gap by UV-Vis spectroscopy, absorption/transmission. Density of states in 2D, 1D and 0D (qualitatively), Practical examples of low-dimensional systems (quantum wells, wires, and dots).

**UNIT V - INTRODUCTION TO SOLARCELLS: 9**

Solarradiation–solarspectrum–solarenergy–photovoltaiceffect–fundamentalsofsolarcells–current–voltagecharacteristics– conversion efficiencyand power.Types of solar cells – silicon solar cells – thin film solar cells – dye sensitized solar cells.CelltoModule–Applications: Fabricationof solar panels–solarwater heating– solarconcentrators.

**TEXTBOOKS:**


1. Joachim Piprek, Semiconductor Optoelectronic devices, Introduction to Physics and simulation,(2013).
2. R. Murugeshan and KiruthikaSivaprasath, Modern Physics, S. Chand Publishers, 18th Edition(2019)
3. Arvind Shah, Solar Cells and modules (2020).


REFERENCES:


1. Sergio M Resande, Introduction to Electronic Materials and Devices (e-book), Springer Link, First Edition (2022).
2. Arthur Beiser, Shobit Mahajan and S. Rai Choudhury, Concepts of Modern Physics, 7th edition, McGraw Hill (2017)
3. Fundamentals of Solar Astronomy by Arvind Bhatnagar and William Livingston, latest edition, World scientific.
4. Roberto Fornari, Single Crytals of Electronic Materials: Growth and Properties, (2018)
5. YuriyPoplavko, Electronic Materials: Principles and Applied Science, (2018)
6. Atul Tiwari, Rabah Boukherroub, Maheshwar Sharon,Solar Cell Nanotechnology,(2013).


**WEB REFERENCES:**

1. **https://en.wikipedia.org/wiki/Crystal_structure**
2. **http://che.uri.edu/course/che333/Structure.pdf**
3. **http://che.uri.edu/course/che333/Structure.pdf**
4. **https://byjus.com/jee/semiconductors/#:~:text=What%20are%20Semiconductors%3F,such%20as%20germanium%20or%20silicon**.
5. **https://ggnindia.dronacharya.info/CSE-AI-ML/Downloads/SubInfo/IstYear/Physics/Unit_4.pdf**

6. **https://metsolar.eu/blog/introduction-photovoltaics-solar-cells/**

**CO PO MAPPING:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO 1** | 3 | 2 | 2 | | | | | | | | 3 | 3 |
| **CO 2** | 3 | 2 | 2 | 1 | | | | | | | | 3 |
| **CO 3** | 3 | 2 | 2 | 1 | | | | | | | | 3 |
| **CO 4** | 3 | 2 | 2 | 1 | | | | | | | | 3 |
| **CO 5** | 3 | 2 | 2 | 1 | | | | | | | 2 | 3 |

| Course Code | ENGINEERING MECHANICS (for non circuit branches) | L | T | P | C |
|---|---|---|---|---|---|
| ME620012 | | 3 | 0 | 0 | 3 |
| **Course Category:** *Industrial Core* | **Course Type:***Theory* | | | | |

Course Objective(s):

To Learn the use scalar and vector analytical techniques for analyzing forces in statically determinate structures, introduce the equilibrium of rigid bodies, free body diagram, learn the principles of friction, forces, determine the apply the concepts of frictional forces at the contact surfaces of various engineering systems and develop basic dynamics concepts – force, momentum, work and energy;

**Course Outcomes: (COs)**

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

| | |
|---|---|
| **CO 1** | Illustrate the vectorial and scalar representation of forces and moments and analyze the equilibrium of particles, bodies and trusses |
| **CO 2** | Evaluate the properties of surfaces and solids |
| **CO 3** | Determine the friction and the effects by the laws of friction |
| **CO 4** | Explain the various types of motion and Calculate velocity, acceleration for various types of motion. |
| **CO 5** | Calculate the dynamic forces exerted in rigid body |

**UNIT I-BASIC CONCEPTS & STATICS ` 9**

Introduction: idealizations of mechanics, vector and scalar quantities, equality and equivalence of vectors, laws of mechanics, elements of vector algebra. Important vector quantities: position vector, moment of a force about a point, the couple and couple moment, moment of a couple about a line.Equivalent force systems: translation of a force to a parallel position, resultant of a force system. Equations of equilibrium: free - body diagram, problems of equilibrium. Applications of equations of equilibrium for Trusses.

**UNIT II-PROPERTIES OF SURFACES 9**

Introduction to properties of surfaces: first moment and centroid of plane area by integration method, second moments and product of area for a plane area, polar moment of area, principal axes. Method of virtual work: principles of virtual work for rigid bodies and its applications.

**UNIT III- FRICTION** **9**

Introduction to friction, Friction forces: laws of Coulomb friction, simple contact friction problems; Cables and chains. Ladder friction.

**UNIT IV- KINEMATICS OF A PARTICLE** **9**

Introduction, general notions, differentiation of a vector with respect to time, velocity and acceleration calculations in rectangular coordinates, velocity and acceleration in terms of path variables and cylindrical coordinates, simple kinematical relations and applications.

**UNIT V- DYNAMICS OF A PARTICLE** **9**

Introduction, Newton's law for rectangular coordinates, rectilinear translation, Newton's law for cylindrical coordinates, Newton's law for path variables, energy and momentum methods: Introduction to conservation of mechanical energy, Work - energy equation, impulse and momentum relations, Impact on Elastic Bodies

**TEXTBOOKS:**


1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, Sanjeev Sanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education., 12thEdition, 2019.
2. Vela Murali, "Engineering Mechanics-Statics and Dynamics", Oxford University Press, 2018.

**REFERENCES:**


1. Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.
2. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.
3. Irving H. Shames, Krishna Mohana Rao G, Engineering Mechanics – Statics and Dynamics, 4thEdition, Pearson Education Asia Pvt. Ltd., 2005.
4. Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013.
5. Timoshenko S, Young D H, Rao J V and SukumarPati, Engineering Mechanics, 5thEdition, McGraw Hill Higher Education, 2013.


**WEB REFERENCES:**

- www.digimat.in/nptel/courses/video/112106180/L20.html
- https://archive.nptel.ac.in/courses/112/103/112103109/
- https://www.youtube.com/watch?v=LF9POom6uto
- https://www.youtube.com/watch?v=RGT1g_lu440
- https://www.youtube.com/watch?v=yuLpPoxj_48
- https://www.youtube.com/watch?v=hvSAVJ64Z4k

**CO -PO MAPPING:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO 1** | 3 | 2 | 2 | 1 | | | | | | | | 2 |
| **CO 2** | 3 | 2 | 2 | 1 | | | | | | | | 2 |
| **CO 3** | 3 | 2 | 3 | 1 | | | | | | | | 2 |
| **CO 4** | 3 | 2 | 3 | 1 | | | | | | | | 2 |
| **CO 5** | 3 | 2 | 3 | 1 | | | | | | | | 2 |

| Course Code | FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE (for circuit branches) | L | T | P | C |
|---|---|---|---|---|---|
| CS620013 | | 3 | 0 | 0 | 3 |
| **Course Category:** ***Industrial Core*** | **Course Type:*****Theory*** | | | | |

Course Objective(s):

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.

**Course Outcomes: (COs)**

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

| | |
|---|---|
| **CO 1** | Use appropriate search algorithms for any AI problem |
| **CO 2** | Represent a problem using first order and predicate logic |
| **CO 3** | Provide the apt agent strategy to solve a given problem |
| **CO 4** | Design software agents to solve a problem |
| **CO 5** | Design applications for NLP that use Artificial Intelligence |

**UNIT I - INTRODUCTION 9**

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems – Machine Learning and its contribution in AI

**UNIT II - PROBLEM SOLVING METHODS 9**

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

**UNIT III - KNOWLEDGE REPRESENTATION 9**

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

**UNIT IV- SOFTWARE AGENTS 9**

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

**UNIT V- APPLICATIONS 9**

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving

**TEXT BOOKS:**

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach‖, Prentice Hall, Third Edition,2009.

2. I. Bratko, ―Prolog: Programming for Artificial Intelligence‖, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

**REFERENCES:**

1. M. Tim Jones, ―Artificial Intelligence: A Systems Approach(Computer Science)‖, Jones and Bartlett Publishers, Inc.; First Edition, 2008

2. Nils J. Nilsson, ―The Quest for Artificial Intelligence‖, Cambridge University Press, 2009.

3. William F. Clocksin and Christopher S. Mellish,‖ Programming in Prolog: Using the ISO Standard‖, Fifth Edition, Springer, 2003.

4. Gerhard Weiss, ―Multi Agent Systems‖, Second Edition, MIT Press, 2013.

5. David L. Poole and Alan K. Mackworth, ―Artificial Intelligence: Foundations of Computational Agents‖, Cambridge University Press, 2010.

**WEB RESOURCES:**

https://www.youtube.com/watch?v=61RbzGBpBIs

https://www.youtube.com/watch?v=CXtN2fik8L0

https://www.youtube.com/watch?v=2iHaSVEadiI

https://www.youtube.com/watch?v=Oth_jnB5lOA

**CO PO MAPPING:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **P12** |
| **CO 1** | 1 | 1 | | | | | | | | 1 | | 1 |

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

| Course Code | Python Programming | L | T | P | C |
|---|---|---|---|---|---|
| CS620014 | | 3 | 0 | 0 | 3 |
| **Course Category:** *Industrial Core* | **Course Type:** *Theory* | | | | |

Course Objective(s):

1.To read and write simple Python programs.
2.To develop Python programs with conditionals and loops.
3.To define Python functions and call them.
4.To use Python data structures –- lists, tuples, dictionaries.
5.To understand the concepts of Files, Modules and Package

**Course Outcomes: (COs)**

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

| | |
|---|---|
| **CO 1** | Apply the Demo Read, write, execute by hand simple Python programs. |
| **CO 2** | Analyze the structure, simple Python programs for solving problems. |
| **CO 3** | Understand the Decomposition of a Python program into functions. |
| **CO 4** | Apply the Representation of compound data using Python lists, tuples and dictionaries. |
| **CO 5** | Understand Read and write data from/to files in Python Programs |

**UNIT I –INTRODUCTION** **9**

Introduction to Python, Demo of Interactive and script mode, Tokens in Python – Variables, Keywords, Comments, Literals, Data types, Indentation, Operators and its precedence, Expressions, Input and Print functions.

**UNIT II - CONTROL FLOW** **9**

Conditionals: Boolean values and operators, Selective statements – if, if-else, nested if, if –elif ladder statements ,Iteration: state, while, for, break, continue, pass , Illustrative programs: square root, gcd, exponentiation, sum an array of numbers.

**UNIT III - FUNCTIONS AND STRINGS** **9**

Functions: Types of Functions, Fruitful functions: return values, parameters, local and global scope, function composition, recursion,Strings: Formatting, Comparison, Slicing, Splitting, Stripping, Negative indices, String functions.

**UNIT IV - LISTS TUPLES AND DICTIONARIES** **9**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value, Dictionary: Create, add, and replace values, operations on dictionaries. Sets: Create and operations on set.

**UNIT V - FILES,MODULES AND PACKAGES** **9**

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file

**TEXT BOOKS:**

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016. (http://greenteapress.com/wp/think-python/)
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

**REFERENCES:**

1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013.
3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013

**CO PO MAPPING:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO 1** | 1 | | 2 | | | | | | | | | |
| **CO 2** | 1 | 1 | | | 2 | | | | | | | |
| **CO 3** | 2 | | 3 | | | | | | | | | |
| **CO 4** | 2 | 1 | | | | | | | | | | |
| **CO 5** | 2 | | | | 2 | | | | | | | 2 |

| Course Code | BASIC ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| EE620015 | | 3 | 0 | 0 | 3 |
| **Course Category:** *Industrial Core* | **Course Type:** *Theory* | | | | |

Course Objective(s):

Giving the knowledge about basic construction materials, surveying, electrical, manufacturing processes and computer generations.

**Course Outcomes: (COs)**

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

| | |
|---|---|
| **CO 1** | Explain the usage of construction material , proper selection of construction materials and also measure distances and area by surveying |
| **CO 2** | Understand about Engineering Materials and IC Engines |
| **CO 3** | Compute electric circuit parameter for simple problems |
| **CO 4** | Understand the working principle of electronic devices such as diodes and zener diodes. |
| **CO 5** | Understand the concepts of generation of computers and its applications |

**UNIT I -** CONSTRUCTION MATERIALS & SURVEYING 9

Construction Materials – Properties, Types and uses of Stone, Bricks, Sand, Cement, Steel. Stone Masonry - Brick Masonry – Types. Types and Uses of Beam, Column, Lintels, Flooring, Roofing. Foundation – Footings – Types. Basic Requirements of Building – Planning – Criteria. Surveying - Object of Surveying – Classification of Surveying – Instruments used for Chain surveying – Calculation of Areas. Leveling – Principle of leveling – Types – Plane Table Surveying.

**UNIT II -MANUFACTURING PROCESS AND IC ENGINES 9**

Casting, Moulding, Patterns, Metal Working: Hot Working and Cold Working, Meta Forming: Extrusion, Forging, Rolling, Drawing, IC Engines: 2 - Stroke and 4 – Stroke Engines, S.I. Engine and C.I. Engine: Differences

**UNIT III - ELECTRICAL CIRCUITS 9**

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state) Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only)

**UNIT IV - BASIC ELECTRONICS 9**

Intrinsic semiconductors, Extrinsic semiconductors – P-type and N-type, P-N junction, VI Characteristics of PN junction diode, Zener effect, Zener diode, Zener diode CharacteristicsRectifier circuits-Wave shaping circuit.

**UNIT V- BASIC COMPUTER APPLICATIONS** **9**

Generation of Computers – Applications of 5 th generation computers – Basic concept of Networking – Server & Client - Network Topologies Internet, World Wide Web: Introduction to Internet, Internet Access, Internet Basics-World Wide Web (WWW), Web Pages. E-mail: Introduction to e-mail, Mailing basics.

**TEXT BOOKS:**


1. Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2015
2. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", McGraw Hill Education, 2014.
3. Sadhu Singh, Basic Mechanical Engineering, S. Chand Publishing, 2009.


**REFERENCE BOOKS:**


1. SeetharamanS.,"Basic Civil Engineering",Anuradha Agencies,2005.
2. Pravinkumar, Basic Mechanical Engineering, Pearson Education; Second edition (30 May 2018)
3. R. K. Rajput, Basic Mechanical EngineeringLaxmi Publications; Fourth edition (1 January 2007).
4. Thomas L. Floyd, 'Electronic Devices', 10th Edition, Pearson Education, 2018.
5. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017


**WEB RESOURCE:**

1. https://www.youtube.com/watch?v=ehi_hkLlutw
2. https://archive.nptel.ac.in/courses/112/103/112103262/

**CO PO MAPPING:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **P12** |
| **CO 1** | 1 | 2 | 1 | | | | 2 | | 2 | 2 | 1 | 2 |
| **CO 2** | 2 | 2 | 1 | | | | 2 | | 2 | 2 | 2 | 2 |
| **CO 3** | 2 | 3 | 2 | 3 | | | | | | | 1 | 1 |
| **CO 4** | 2 | 3 | 3 | 3 | 3 | 1 | - | 1 | 1 | - | 1 | 3 |
| **CO 5** | 1 | 1 | 1 | | | | 1 | | 1 | 1 | 1 | 3 |

| Course Code | PYTHON PROGRAMMING LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| IP620103 | | 0 | 0 | 3 | 1.5 |
| | **Course Type:** ***Practical*** | | | | |

Course Objective(s):

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

**Course Outcomes: (COs)**

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

| | |
|---|---|
| **CO 1** | Write, test, and debug simple Python programs |
| **CO 2** | Implement Python programs with conditionals and loops. |
| **CO 3** | Develop Python programs step-wise by defining functions and calling them. |
| **CO 4** | Use Python lists, tuples, dictionaries for representing compound data. |
| **CO 5** | Read and write data from/to files in Python. |

**LIST OF EXPERIMENTS:**

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

**CO PO MAPPING:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO 10** | **PO 11** | **PO 12** |

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

| Course Code | ENGINEERING PRACTICE LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| IP620104 | | 0 | 0 | 3 | 1.5 |
| | Course Type:*Practical* | | | | |

Course Objective(s):

To provide hands on training in Sawing, planning, making joints in wood materials used in common household wood work, drawing pipe line plan; laying and connecting various pipe fittings used in common, household plumbing work, making a tray out of metal sheet using sheet metal work, wiring various electrical joints in common household electrical wire work and Soldering and testing simple electronic circuits, house wiring system, measurement of electrical quantities, and handling electrical equipment.

**Course Outcomes: (COs)**

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

| | |
|---|---|
| **CO 1** | Draw pipe line layout and connect various pipe fittings used in common household plumbing work |
| **CO 2** | Make a tray out of metal sheet using sheet metal work and join the components using Screws, bolts and rivets. |
| **CO 3** | Design House wiring system and measure the various electrical quantities in a circuit |
| **CO 4** | Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB. |
| **CO 5** | Set IP address, Connecting two computers and verify data transmission. |

**EXERCISES**

**CIVIL:**

Carpentry& Plumbing: 9

1. Wood sizing exercise in planning, marking, sawing, chiseling and grooving to make; Tee Joint and Dovetail Joint.
2. Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
3. Laying pipe connection to the suction side of a pump
4. Laying pipe connection to the delivery side of a pump.
5. Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

MECHANICAL:

Sheet Metal & Fasteners: 9

1. Fabrication of Dust Pan
2. Fabrication of Square tray.
3. Making bolted joints, screw joints and riveted joints.

ELECTRICALS: 9

1. Residential House wiring using switches, fuse, indicator, lamp and Energy meter
2. Different Types of wiring (Staircase and Fluorescent Lamp wiring)
3. Verification of Ohm's law
4. Measurement of Electrical quantities (Voltage, current, power and power factor in RLC series circuit)
5. Calculation of Magnetic flux in an electrical circuit.

ELECTRONICS: 9

1. Characteristics of PN junction diode
2. Characteristics of Zener diode
3. Half wave and full wave Rectifiers
4. Application of Zener diode as shunt regulator.
5. Characteristics of BJT and JFET

COMPUTER SCIENCE: 9

1. Setting IP address to the client system
2. Network cable crimping and Installation
3. Connecting two computers and verify data transmission
4. Folders and peripherals sharing
5. Creating mail ID

**CO PO MAPPING:**

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

# INSTITUTE MANDATORY COURSE

| Course Code | ENVIRONMENTAL STUDIES | L | T | P | C |
|---|---|---|---|---|---|
| IM610401 | | 2 | 0 | 0 | 0 |
| **Course Category:** *Institute Mandatory* | **Course Type:***Theory* | | | | |

Course Objective(s):

The course deals with the fundamentals of environmental engineering and its application in pollution control. It is intended to impart the fundamental knowledge of environmental engineering along with the design aspect of some pollution control equipment. It will also help the young scientific professionals to keep their knowledge upgraded with the current thoughts and newer technology options along with their advances in the field of the environmental/industrial pollution abatement.

**Course Outcomes: (COs)**

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

| | |
|---|---|
| **CO 1** | Identify the sources and effects of pollutants to the environment |
| **CO 2** | Understand the various treatment technologies for industrial wastewater |
| **CO 3** | Understand the development and applications of various unit operation to control the toxic Elements. |
| **CO 4** | Identify the effect of the behavior of air& noise pollutants on the environment. |
| **CO 5** | Create awareness about environmental impact assessment (EIA)&Sustainable Development. |

**UNIT I - INTRODUCTION** **4**

Man and environment, types of pollution, pollution controls aspects, Industrial pollution, pollution monitoring and analysis of pollutants, Indian pollution regulations Environmental quality and degradation, Industrial scenario in India.

**UNIT II - INDUSTRIAL WASTEWATER TREATMENT** **6**

Sources and types of industrial wastewater – Nature and Origin of Pollutants - Industrial wastewater and environmental impacts. Regulatory requirements for treatment of industrial wastewater. Industrial Wastewater Treatment method-MembraneTechnologies

**UNIT III - SOLID WASTE MANAGEMENT:** **6**

Type of waste collection systems, analysis of collection system –alternative techniques for collection system. Separation and Processing and Transformation of Solid Waste: unit operations user for separation and processing, Landfills**:** Site selection, design and operation, drainage and leachate collection systems –E waste - sources, collection, treatment and reuse management., Hazardous waste treatment technologies (Management & Handling) Rules,

**UNIT IV - AIR & NOISE POLLUTION** **8**

Air Pollution: Types of pollutants, their sources and impacts, air pollution meteorology, Equipments for control of pollution, air quality standards and limits. Noise Pollution: Types of noise, Impacts of noise, permissible limits of noise pollution, measurement of noise and control of noise pollution Effects on human being.

**UNIT V - ENVIRONMENTAL LAWS& SUSTAINABLE DEVELOPMENT** **8**

Environmental regulations and policies; Environmental protection laws and acts; Corporate and international charters and protocols; Standards and Guidelines, Historical development of Environmental Impact Assessment; Towards Sustainable Future:Concept of Sustainable Development, Life cycle assessment; Environmental auditing; Eco-labelling of products; Environmental management systems particularly IS 14000 series.Concept of Green Computing.

**TEXT BOOKS:**

1.M.N. Rao, "Air Pollution", Tata McGraw Hill, 2018
2.Jeffrey Pierce J, "Environmental pollution and control", Butterworth-Heinemann,1998
3. Nicholas P. Cheremisinoff, Handbook of Air Pollution Prevention and Control. Butterworth-Heinemann, 2002
4. Noel de Nevers, Air Pollution Control Engg., McGraw-Hill, New York, 2012
5. N.K.Uberoi, Environmental Management, Excel Books, 2006
5. Singal, S.P., Noise Pollution and Control Strategy, Narosa Publishing House,,2005

**REFERENCES:**

1. Westlake, K, Landfill Waste pollution and Control, Albion Publishing Ltd., England,1995.
2. Garg, S.K., "Environmental Engineering Vol. I & II", Khanna Publishers, New Delhi2012
3. Modi, P.N., "Environmental Engineering Vol. I & II", Standard Book House, Delhi 2013
4. Canter, W.L., Environmental Impact Assessment, McGraw-Hill Inc., 1992
5. Rau, J.G and Wooten, D.C., Environmental Impact Analysis Handbook, McGraw-Hill, 2015.
7. UNEP/IED Technical Report Serial No.2., Environmental Auditing, 1990.
8.. Metcalf &Eddy., Wastewater Engineering – Treatment and Reuse, Tata Mc. Graw-Hill Company, 2019

**WEB REFERENCES:**

1. https://nptel.ac.in/courses/105/106/105106056/
2. https://nptel.ac.in/courses/105105178
3. MEVE-001: Environmental Impact Assessment for Environmental Health - Course (swayam2.ac.in)
4. https://moef.gov.in/wp-content/uploads/wssd/doc2/ch2.html
5. https://nptel.ac.in/courses/120108004

**CO PO MAPPING:**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO 1** | 2 | 1 | 2 | | | 2 | 2 | | | | | 2 |
| **CO 2** | 3 | 2 | 2 | 2 | | 2 | 2 | | | | | 2 |
| **CO 3** | 3 | 2 | 2 | 2 | | 2 | 3 | | | | | 2 |
| **CO 4** | 3 | 2 | 2 | 1 | | 2 | 2 | | | | | 2 |
| **CO 5** | 3 | 1 | 2 | | | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

# SEMESTER III

IC630017 - **NUMERICAL METHODS AND STATISTICS**

| **Course Category: Institute Core** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

The objective of this course is to computing a value and being aware of two or more comparable values. When data series are organised as columns, interpolation occasionally aims to predict the future and should be representative in order for researchers to draw conclusions about the larger population and to approximate a bigger population on factors pertinent to the research subject.

| **UNIT 1: SOLUTION OF EQUATION AND EIGNVALUE PROBLEM** | **9** |
|---|---|

Solution of linear system of equation – Bijection method – fixed point Iteration method – Newton Raphson Method – Ragula Falsi method – Decomposition Method – Gauss Elimination Method – Gauss Jordan Method – Gauss Jacobi Method –Finding largest eigen value- Inverse of matrix by Jordan Method.

| **UNIT 2: INTERPOLATION AND APPROXIMATING POLYNOMIALS** | **9** |
|---|---|

Lagrangian polynomials – Divided difference formulae for equal intervals and unequal intervals – Interpolating with a cubic spline – Newton's forward and backward difference formulas – Stirlings formula.

| **UNIT 3: NUMERICAL DIFFERENTIATION AND INTEGRATION** | **9** |
|---|---|

Differentiation using interpolation formulae – Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rule – Romberg's Method – Double integrals using trapezoidal and Simpson's rules.

| **UNIT 4: THEORY OF ESTIMATION** | **9** |
|---|---|

Estimation: Point and Interval estimates for population parameters of large sample and small samples, determining the sample size.

| **UNIT 5: TESTING OF HYPOTHESIS** | **9** |
|---|---|

Sampling distributions – Testing of hypothesis for mean – variance –proportions and differences using Normal–'t'–Chi-square and F-distributions–Tests for independence of distributions of attributes and goodness of fit

**TOTAL: 45 PERIODS**

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

CO1: Compute the solutions of the variables using iterative methods.

CO2: Understand and apply methods to find interpolating and approximating polynomials.

CO3: Solve complicated differentiation and integration by numerical methods.

CO4: Identify the type of estimations for small samples and large samples.

CO5: Solve the physical problems by small and large sampling theory.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | | | | | | 1 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 1 | 2 | 2 | 3 | | | | | | 3 | 3 | 1 |
| CO3 | 3 | 2 | 3 | 3 | 3 | | | | | | 1 | 3 | 2 | 3 |
| CO4 | 3 | 2 | 2 | 1 | 3 | 3 | | | | | | 3 | 2 | 2 |
| CO5 | 3 | 2 | 2 | 2 | 2 | | | | | | | 3 | 2 | 2 |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**


1. M.K. JAIN, S.R.K. IYENGAR and R.K. JAIN "Numerical methods: for scientific and engineering computation" 2013. 6th ed.,

2. DEVORE, J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning , New Delhi, 8th Edition, 2014.

3. S.C. GUPTA AND V.K. KAPOOR "*Fundamentals of mathematical statistics*" Elevanth thoroughly revised ed., Sultan Chand & Sons educational publishers, New Delhi (June 2003)

4. T. VEERARAJAN, "*Probability, Statistics and Random Processes"* Tata McGraw-Hill Publishing Company Limited, New Delhi(2006)


**REFERENCE BOOKS:**


1. SANKARARAO.K " Numerical Methods for Scientists and Engineers" -3rd edition Printice Hall of India Private Ltd. New Delhi-(2007).

2. WALPOLE, R.E., MYERS, R.H., MYERS, S.L. and YE. K., "Probability and Statistics For Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2010

3. VEERARAJAN.T AND RAMACHANDRAN. T " Numerical Methods with Programming in C" second Ed., Tata Mc. Graw Hill Publishing. Co. Ltd (2007)

CS630201 - **COMPUTER ORGANIZATION AND ARCHITECTURE**

| **Course Category: Programme Core** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To understand basics of computer organization and architecture
- To learn about components of a computer
- To understand the working of CPU and control unit
- To learn about the RISC and ILP
- To understand the basics of parallel processing using computers

**UNIT 1: OVERVIEW** **9**

Introduction: Organization and Architecture - Structure and Functions - Computer Evolution and Performance: Designing for Performance - The Evolution of the Intel x86 architecture - Instruction Sets Characteristics and Functions: Machine instruction characteristics-Types of operands - Instruction set Addressing Modes and Formats: Addressing

**UNIT 2: COMPUTER SYSTEM** **9**

A Top-Level View of Computer Function and Interconnection: Computer Components-Interconnection Structures. Cache Memory: Cache Memory Principles -Elements of Cache Design - Internal Memory Technology - External Memory: RAID - Magnetic Disk - Input / Output: External Devices-I/O Modules-Direct Memory access.

**UNIT 3: CENTRAL PROCESSING UNIT AND CONTROL UNIT** **9**

Computer Arithmetic: Integer Arithmetic and Floating-Point Arithmetic. Control Unit Operation: Micro Operations-Hardwired Implementation - Micro Programmed Control: Micro Instruction Sequencing - Micro Instruction Execution-Macro processing

**UNIT 4: RISC AND INSTRUCTION LEVEL PARALLELISM** **9**

Reduced Instruction Set Computers: RISC Pipelining - MIPS R4000 - RISC Vs CISC - Instruction Level Parallelism and Super Scalar Processor – Overview - Design Issues – Pentium 4 - IA-64 Architecture: IA-64 Instruction Set Architecture-RISC applications.

**UNIT 5: PARALLEL PROCESSING** **9**

Parallel Organization: Parallel Processing - Multiple Processor Organization - Symmetric Multiprocessor -Cache Coherence and the MESI Protocols - Multi threading – Clusters

**TOTAL: 45 PERIODS**

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

CO1: Understand the basic concepts of computer system.

CO2: Understand the concept of computer components.

CO3: Analyze the various operations on various components.

CO4: Analyze the different techniques on RISC like types.

CO5: Understand the concept of computer applications.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 2 | | | | | | | | | 2 | | |
| CO2 | 2 | 1 | 1 | | | | | | | | | | | |
| CO3 | 1 | 2 | 2 | | | | | | | | | 1 | | |
| CO4 | 2 | 1 | 1 | | | | | | | | | 2 | | |
| CO5 | 2 | 2 | 2 | | | | | | | | | 1 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.William Stallings, "Computer Organization and Architecture Designing for Performance", Seven Edition, Pearson Education, 2009.

2.C. Siva Ram Murthy, K.N. Balasubramanya Murthy, Srinivas Aluru, "Fundamentals of Computer Organization And Architecture",2005.

3.M. Abd-El-Barr, "Fundamentals Of Computer Organization And Architecture" ,2005.

**REFERENCE BOOKS:**

1.John L. Hennessy, David A. Patterson, "Computer Architecture: A Quantitative Approach", FifthEdition, Morgan Kaufmann, 2011.

2.David A. Patterson, John L. Hennessy, "Computer Organization and Design the Hardware/Software Interface", Fourth Edition, Morgan Kaufmann,2008

3.Alan Clements, "Computer Organization and Architecture: Themes and Variations, First Edition Hardcover, 2013"

**WEB RESOURCES:**

1.Microprocessors And Microcontrollers - swayam.gov.in/nd1_noc20_ee42/preview

2.PIC Microcontroller - pic-microcontroller.com/online-courses-learn-pic

| CS630202 - **DATA STRUCTURE USING C++** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Core** | **Course Type: : Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To understand the basic concepts of OOPS and basic constructs in C++
- To learn how to define classes, objects, statements and constructors in C++
- To understand the concepts of operator overloading and inheritance in C++
- To understand the concepts of linear data structures and sorting
- To understand the basic concepts of related to operating systems and computer networks

| **UNIT 1: INTRODUCTION TO OOPS AND C++** | **9** |
|---|---|

Object oriented programming paradigm – Basic concepts of object oriented programming – Benefits of OOP – A simple C++ program - Basics of C++**:** Tokens – Keywords – Identifiers and constants – Basic data types - Declaration of variables – Operators in C++ – Scope resolution operator – Operator precedence.

| **UNIT 2: CONTROL STRUCTURES AND STATEMENTS IN C++** | **9** |
|---|---|

Control structures in C++: if statement – switch statement – do-while statement – while statement – else statement - for statement - Functions in C++: Introduction - The main function – Function prototyping – Call by reference – Return by reference – Inline functions - Method overloading – friend and virtual functions – Math library functions.

| **UNIT 3: BASIC OOPS CONCEPTS IN C++** | **9** |
|---|---|

Specifying a class – Defining member functions – A C++ program with class – Parameterized constructors – Multiple constructors in a class – Constructors with default arguments – Copy constructor – Destructors - Operator overloading – Inheritance - Single inheritance – Multilevel inheritance – Multiple inheritance – Hierarchical inheritance – Hybrid inheritance.

| **UNIT 4: BASIC DATA STRUCTURES AND SORTING** | **9** |
|---|---|

Algorithm – Analysis – List ADT – Stack ADT – Queue ADT – Priority Queue – Stack implementation – Basic operations on stack – Application of stack – Queue: Introduction – Definition of Queue –implementation of Queue – Operation on a Queue – Applications of Queue – Sorting : bubble sort-Insertion sort - Merge sort - Quick sort-Searching - hashing

| **UNIT 5: GRAPH AND TREES** | **9** |
|---|---|

Trees: Introduction – Tree – Basic elements of a tree – Binary tree – Representation of binary tree – Operations on binary tree – AVL Tcree – Operations on AVL Tree - Graph: Representation - Shortest path algorithm: Dijikstra's algorithm - Minimum spanning tree: Prim's Algorithm

**TOTAL: 45 PERIODS**

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

CO1: Understand the difference between object oriented programming and procedural oriented language and data types in C++

CO2: Implement C++ programs with features such as composition of objects, Polymorphism.

CO3: Implement C++ programs with features such as Operator overloading and inheritance

CO4: Choose an appropriate data structure for a particular problem

CO5:Simulate problems in the subjects like Operating system, Computer networks and also real world problems in C++

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 2 | | | | | | | | 1 | 2 | | |
| CO2 | 2 | 1 | 1 | | | | | | | | | 1 | | |
| CO3 | 1 | 2 | 2 | | | | | | | | 2 | 1 | | |
| CO4 | 2 | 1 | 1 | | | | | | | | 1 | 2 | | |
| CO5 | 2 | 2 | 2 | | | | | | | | | 1 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.E.Balagurusamy, "Object Oriented Programming with C++", Fifth Edition, Tata McGraw Hill, 2011 (Unit I,II and III)

2.Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Third edition, Pearson Education Asia, 2010. (Unit IVand V)

3. D.S.Malik, " Data Structures using C++", Second Edition,2010.

**REFERENCE BOOKS:**

1.M.T. Somashekara, Programming In C++, PHI Pvt. Ltd., 2008

2.B.Trivedi, Programming with ANSI C++, Oxford University Press, 2007

3.**Rajesh K. Shukla**, "Data Structures using C & C++",2019.

**WEB RESOURCES:**

1.https://www.edx.org/course/data-structures-algorithms-using-c

2.https://www.includehelp.com/c-programming-data-structure-examples.aspx

CS630203 - **DATABASE MANAGEMENT SYSTEMS**

| **Course Category: Programme Core** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To study the basic organization of a Database Management System.
- To study about Relational Database Management Structure
- To study about the design issues of a Database
- To study about transaction management of the database
- To study about various implementation techniques

**UNIT 1: INTRODUCTION** **9**

Purpose of Database System - Files versus database systems – View of Data – Database Language - Database Architecture – Database users and administrators – History of Database System - E-R model – Constraints- E-R Diagram

**UNIT 2: RELATIONAL MODEL** **9**

Relational Model – Structure of Relational Databases – Relational Algebra Operations – Null Values – Modification of Relational Databases- SQL – Advanced SQL- Integrity Constraints – Authorization – Embedded SQL – Dynamic SQL- The Tuple Relational Calculus – The Domain Relational Calculus - QBE – Triggers.

**UNIT 3: DATABASE DESIGN** **9**

Functional Dependencies – Non-loss Decomposition – Functional Dependencies – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form- Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

**UNIT 4: TRANSACTIONS** **9**

Transaction Concepts - Transaction Recovery – ACID Properties – System Recovery – Media Recovery – Two Phase Commit - Save Points – SQL Facilities for recovery – Concurrency – Need for Concurrency – Locking Protocols – Two Phase Locking – Intent Locking – Deadlock- Serializability – Recovery Isolation Levels – SQL Facilities for Concurrency.

**UNIT 5: IMPLEMENTATION TECHNIQUES** **9**

Physical Storage Media – Magnetic Disks – RAID – Tertiary storage – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static and Dynamic Hashing – Query Processing Overview – Catalog Information for Cost Estimation – Selection Operation – Sorting – Join Operation – Web Technology and DBMS – Web as a Database Application Platform

**TOTAL: 45 PERIODS**

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

CO1: Understand the major objectives of database technology

CO2: Understand the relational model for databases

CO3: Design issues of Database

CO4: Identify the problems in Transaction

CO5:Analyze the issues involved in Implementation

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 2 | | | | | | | | 1 | 2 | | |
| CO2 | 2 | 2 | | | | | | | | | 2 | | | |
| CO3 | 1 | 2 | 1 | | | | | | | | 1 | 1 | | |
| CO4 | 2 | 1 | | | | | | | | | 2 | 2 | | |
| CO5 | 1 | 2 | 2 | | | | | | | | 2 | 1 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2011 (Unit I and Unit-V).

2.C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.( Unit II, III and IV)

3. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill 3rd Edition.

**REFERENCE BOOKS:**

1.M.T. RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Fourth Edition , Pearson / Addisionwesley, 2007.

2.Raghu Ramakrishnan, "Database Management Systems", Third Edition, McGraw Hill, 2003., "Programming In C++", PHI Pvt. Ltd., 2008

3.Fundamentals of Database Systems, Elmasri Navathe Pearson Education.

**WEB RESOURCES:**

1.https://www.inmotionhosting.com/blog/what-is-a-database-management-system/

2.https://www.techtarget.com/searchdatamanagement/definition/database-management-system

| CS630204 - **OPERATING SYSTEMS** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Core** | **Course Type: Theory with practical Component** | **L** | **T** | **P** | **C** |
| | | **2** | **0** | **2** | **3** |

**COURSE OBJECTIVES:**

- To gain knowledge about various advanced techniques and concepts involved in operating systems
- To incorporate knowledge to processes and threads
- To know the concept of semaphore and deadlock
- To study about the various storage strategies
- To study about the concepts of I/O systems

| **UNIT 1: OPERATING SYSTEMS OVERVIEW** | **6** |
|---|---|
| Operating system – Main frame systems – Desktop systems – Multiprocessor systems – Distributed systems – Clustered systems – Real-time systems – Handheld systems – Operating System structures: System components – Operating system services - System calls – System programs – System structure | |
| **UNIT 2: PROCESSES AND THREADS** | **6** |
| Process: Process concept – Process scheduling – Operations on processes – Cooperating processes – Interprocess communication – Communication in client-server systems - Threads: Overview - Multithreading models – Threading issues – Pthreads - CPU Scheduling: Basic concepts - Scheduling criteria – Scheduling algorithms – Multiple-processor scheduling – Real time scheduling | |
| **UNIT 3: PROCESS MANAGEMENT** | **6** |
| Process synchronization: The critical-section problem – Synchronization hardware – Semaphores – Classic problems of synchronization – Critical regions – Monitors –Deadlocks: System model – Deadlock characterization – Methods for handling deadlocks – Recovery from deadlock | |
| **UNIT 4: STORAGE MANAGEMENT** | **6** |
| Memory Management: Background -Swapping – Contiguous memory allocation – Paging – Segmentation – Segmentation with paging - Virtual Memory: Background – Demand paging – Process creation – Page replacement – Allocation of frames – Thrashing | |
| **UNIT 5: I/O SYSTEMS** | **6** |
| File-system interface: File concept – Access methods – Directory structure – File-system mounting – File sharing - Protection – File-system implementation: Directory implementation – Allocation methods – Free-space management – Mass storage structure: Disk structure - Disk scheduling – Disk management – Swap-space management | |
| **TOTAL: 30 PERIODS** | |

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

CO1: Understand the fundamental concepts of operating system

CO2: Understand the concept of processes and threads scheduling

CO3: Analyze the various semaphores techniques and the deadlock handling mechanism

CO4: Analyze the different storage management strategies

CO5:Understand the concept of I/O systems

**PRACTICAL EXERCISES: 15 PERIODS**

1.Create new processes and do communicate using pipe
2.Make communication between the processes using shared memory and message queue
3.Simulate the following CPU scheduling algorithms a) FIFO b) SJF c) Priority d) Round Robin
4.Implement Peterson's solution using semaphore
5.Implement dinning philosopher problem using semaphore
6.Simulate Bankers Algorithm for Dead Lock Avoidance
7.Simulate Bankers Algorithm for Dead Lock Prevention
8.Simulate all File Organization Techniques a) Single level directory b) Two level c) Hierarchical d) DAG
9.Simulate Paging Technique of memory management
10.Simulate all page replacement algorithms a) FIFO b) LRU c) LFU

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | 2 | | | | | | 2 | | 1 | 2 | | |
| CO2 | 1 | 2 | 1 | | | | | | 1 | | 2 | | | |
| CO3 | 2 | 2 | 1 | | | | | | 2 | | 2 | 1 | | |
| CO4 | 2 | 1 | 2 | | | | | | 1 | | 1 | 2 | | |
| CO5 | 1 | 2 | 2 | | | | | | 1 | | 1 | 1 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Silberschatz, Galvin and Gagne, "Operating System Concepts", Eighth Edition, John Wiley & Sons Inc., Reprint 2011

2.Avi Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts",Eight Edition

3.Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", Ninth Edition

**REFERENCE BOOKS:**

1.William Stallings, " Operating Systems: Internals and Design Principles" Seventh Edition ,Pearson Education, 2011

2.H M Deital, P J Deital and D R Choffnes, "Operating Systems", Pearson Education, 2004.

3.Pramod Chandra P Bhatt, "An Introduction to Operating Systems : Concepts and Practice", PHI Learning Pvt. Ltd.,2010

**WEB RESOURCES:**

https://www.os-book.com/OS10/

https://drive.uqu.edu.sa/_/mskhayat/files/MySubjects/2017SS%20Operating%20Systems/Abraham%20Silberschatz-Operating%20System%20Concepts%20(9th,2012_12).pdf

| CS630301 - **DATA STRUCTURES USING C++ LABORATORY** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Core** | **Course Type: Practical** | **L** | **T** | **P** | **C** |
| | | **0** | **0** | **3** | **1.5** |

**COURSE OBJECTIVES:**

- To understand the basic concepts of OOPS, Basic constructs in C++
- To learn how to define classes, objects, statements, operator overloading, inheritance and constructors in C++
- To understand the concepts of linear data structures ( arrays, stacks, queues) and sorting
- To understand the usage of graph structures and spanning trees.
- To learn about Huffman Coding

**LIST OF EXPERIMENTS:**

1. Develop a program for finding the sum of individual digits of a given number by using looping statements.
2. Implement a program that uses a function to find the factorial of a given number.
3. Find both the largest and smallest number in a list of integers after arranging them in ascending order by using Array concept.
4. Develop a C++ program that uses to find prime numbers.
5. Implement a program using overloaded constructors
6. Implement a program that illustrates how Single inheritance is supported.
7. Implement a program that illustrate how Multi level inheritance is supported
8. Develop a C++ program for Stack implementation using arrays
9. Implementing an Queue by using arrays
10. Implementing queue ADT using linked list
11. Design and implementing Binary tree traversals
12. Design a C++ program for sorting N numbers using Insertion Sort
13. Design a C++ program for sorting N numbers using Quick Sort
14. Design a C++ program for sorting N numbers using Merge Sort
15. Develop a C++ program for implementing Prim's Algorithm

**TOTAL :45 PERIODS**

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

CO1: Understand the difference between object oriented programming and procedural oriented language and data types in C++

CO2: Implement C++ programs with features such as composition of objects, Polymorphism.

CO3: Implement C++ programs with features such as Operator overloading and inheritance

CO4: Choose an appropriate data structure for a particular problem

CO5:Simulate problems in the subjects like Operating system, Computer networks and also real world problems in C++

**LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS**

**HARDWARE REQUIREMENT:**

- l Desktop Systems - Pentium IV with 2 GB RAM
- 160 GB HARD Disk
- Monitor 1024 x 768 color

**SOFTWARE REQUIREMENT:**

- Windows Operating System.
- Dev C++/C/Equivalent Compiler.
- JDK 1.8

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 2 | | | | | | | | 2 | 2 | | |
| CO2 | 2 | 1 | 1 | | | | | | | | | 2 | | |
| CO3 | 1 | 2 | 1 | | 2 | | | | | | 2 | 1 | | |
| CO4 | 2 | 1 | 2 | | | | | | | | | 2 | | |
| CO5 | 1 | 2 | 2 | | | | | | | | 2 | 1 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.S.Sridhar, "Design and Analysis of Algorithms", Oxford University Press, 1st Edition, 2014.

2.Adam Drozdex, "Data Structures and algorithms in C++", Cengage Learning, 4th Edition, 2013.

3.Ellis Horowitz, SartajShani, SanguthevarRajasekaran, "Fundamentals Of Computer Algorithms". India, Misc, 2010.

**REFERENCE BOOKS:**

1.T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to algorithms", Second Edition, Prentice Hall of India Ltd

2.Mark Allen Weiss, "Data Structures and Algorithms in C++", Pearson Education, 3rd Edition, 2009

**WEB RESOURCES:**

1.http://mlritm.ac.in/assets/img/C%2B%2B%20Lab%20Manual_0.pdf

2.https://mrcet.com/pdf/Lab%20Manuals/CSE/DATA%20STRUCTURES%20USING.pdf

CS630302 - **DATABASE APPLICATION LABORATORY**

| **Course Category: Programme Core** | **Course Type: Practical** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **0** | **0** | **3** | **1.5** |

**COURSE OBJECTIVES:**

- To create and manipulate their own database
- To use SQL Commands for accessing the Database
- To design a small application with backend
- To design a form for various applications
- To implement a mini Project

**LIST OF EXPERIMENTS:**

1. Design and Develop Schema
2. Create Queries for DDL and DML Commands like Insert, Select Commands, Update & Delete Commands.
3. Develop tables using Nested Queries & Join Queries
4. Develop tables using Views
5. Developing various programs using Control structures, Procedures and Functions.
6. Design various User Interfaces as Front end tools
7. Connecting databases with Front end interfaces
8. Form Designing for various applications
9. Menu Design for some simple real time applications
10. Generating reports
11. Database Design and implementation (Mini Project).

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

CO1: Create and manipulate their own databases

CO2: Understand various SQL commands for accessing the database

CO3: Implement a small application with database accessing

CO4: Design a form for various applications

CO5:Implement a mini Project

**LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS**

**HARDWARE REQUIREMENT:**

- 30 Personal Computers

**SOFTWARE REQUIREMENT:**

Front end : VB/VC ++/JAVA

Back end: Oracle 11g, my SQL, DB2

Platform: Windows 2000 Professional/XP

Oracle server could be loaded and can be connected from individual PCs.

**CO-PO MAPPING**

**1- low, 2 - medium, 3 - high, '-' no correlation**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 2 | | | | | | | | 2 | 2 | | |
| CO2 | 2 | 1 | 1 | | 2 | | | | | | 1 | | | |
| CO3 | 1 | 2 | 2 | | 1 | | | | | | | 1 | | |
| CO4 | 2 | 1 | 1 | | 1 | | | | | | 2 | 2 | | |
| CO5 | 2 | 2 | 2 | | | | | | | | 1 | 1 | | |

**TEXT BOOKS**

1.Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2011 (Unit I and Unit-V).

2.C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.( Unit II, III and IV)

**REFERENCE BOOKS:**

1.M.T. RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Fourth Edition , Pearson / Addisionwesley, 2007.

2.Raghu Ramakrishnan, "Database Management Systems", Third Edition, McGraw Hill, 2003., "Programming In C++", PHI Pvt. Ltd., 2008

**WEB RESOURCES:**

https://www.bharathuniv.ac.in/downloads/csc/BCS4L1Database%20Management%20lab.pdf

https://mrcet.com/pdf/Lab%20Manuals/CSE%20II-II%20SEM.pdf

| IM630402 - **UNIVERSAL HUMAN VALUES AND ETHICS** | | | | | | |
|---|---|---|---|---|---|---|
| **Course Category: Institute Mandatory** | **Course Type: Theory** | **L** | **T** | **P** | **C** | |
| | | **2** | **0** | **0** | **0** | |
| **COURSE OBJECTIVES:** | | | | | | |

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education
2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.

| **UNIT 1: COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION** | **6** |
|---|---|
| Need for Value Education, basic guidelines, content and process for Value - the basic requirements for fulfillment of aspirations of every human being with their correct priority. Right Understanding, relationship and Physical Facility. Happiness and Prosperity correctly-understanding and living in harmony at various levels. Process of Value Education – Self-exploration | |
| **UNIT 2: UNDERSTANDING HARMONY IN THE HUMAN BEING** | **6** |
| Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail Programs to ensure Sanyam and Swasthya | |
| **UNIT 3: UNDERSTANDING HARMONY IN THE FAMILY** | **6** |
| Understanding harmony in the Family- the basic unit of human interaction. Understanding values in human-human relationship - the foundational values of relationship. Difference between intention and competence. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship. | |
| **UNIT 4: UNDERSTANDING THE HARMONY IN THE SOCIETY** | **6** |
| Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals. Health and self regulation. Harmony from Family Order to World Family Order – Process of Development of a Child – In an environment of Relationship. | |
| **UNIT 5: UNDERSTANDING HARMONY IN THE NATURE** | **6** |
| Understanding the harmony in the Nature. Interconnectedness, Self-regulation and Mutual Fulfilment among the Four. Realizing Existence as Co-existence at All Levels. Holistic perception of harmony at all levels of existence. | |
| **TOTAL: 30 PERIODS** | |
| **COURSE OUTCOMES:** At the end of the course, the student will be able to, | |
| CO1: Understand the significance of value inputs in a classroom and start applying them in their | |

| |
|---|
| life and profession |
| CO2: Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc. |
| CO3: Understand the value of harmonious relationship based on trust and respect in their life and profession |
| CO4: Understand the role of a human being in ensuring harmony in society and nature. |
| CO5: Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work. |
| **TEXT BOOKS:** |
| 1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics. |
| **REFERENCE BOOKS:** |
| 1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA |
| 2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain. |
| 3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991 |
| 4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books |
| 5. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak. |
| 6. AICTE, FDP –Course material |

# SEMESTER - IV

IC640018 - **BOUNDARY VALUE PROBLEMS AND PROBABILITY DISTRIBUTION**

| **Course Category: Institute Core** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

Objective of the subject is to provide a venue for the promotion, encouragement, and interdisciplinary collaboration of various fields using the theory, techniques, and applications of boundary value problems and Make predictions about the likelihood of specific events using the probability distribution for discrete random variables (general, binomial,). Students will use the normal distribution's fundamentals to calculate probability. Implement a normal distribution. Check out a normal distribution.

| **UNIT 1: INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS** | **9** |
|---|---|

Single Step Methods: Taylor Series Method – Euler Method for First Order Equation – Fourth Order Runge – Kutta Method for Solving First and Second Order Equations – Multistep Methods: Milne's and Adam's Predictor and Corrector Methods.

| **UNIT 2: BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS** | **9** |
|---|---|

Finite Difference Solution of Second Order Ordinary Differential Equation – Finite Difference Solution of One Dimensional Heat Equation by Explicit and Implicit Methods – One Dimensional Wave Equation and Two Dimensional Laplace and Poisson Equations

| **UNIT 3: PROBABILITY AND RANDOM VARIABLES** | **9** |
|---|---|

Random experiment – sample space – concept of probability Axioms of Probability – conditional probability –Total probability - Baye's theorem - Discrete and continuous type of random variables - Moments - Moment generating functions and their properties

| **UNIT 4: STANDARD DISTRIBUTIONS** | **9** |
|---|---|

Discrete distributions: Binomial, Poisson, Geometric, Negative Binomial – Continuous distributions - Uniform, Normal, Exponential, Gamma, and Weibull distributions – Mean and variance of distribution – Method of finding Mean and variance using MGF

| **UNIT 5: TWO DIMENSIONAL RANDOM VARIABLES** | **9** |
|---|---|

Joint distributions - Marginal and conditional distributions -Independent random variables - Covariance - Correlation and Regression - Transformation of random variables - Central limit theorem with its applications.

**TOTAL: 45 PERIODS**

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

CO1: Apply the method of finding numerical solution for differential equation by initial value problems and terminal problem

CO2: Apply the method of finding numerical solution for differential equation by boundary value problems and with their application.

CO3: Gain knowledge about conditional probability and applications of Baye's theorem.

CO4: Identify the different types of distribution and apply in real life.

CO5: Apply the discrete data to analyse the correlation and regression.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 2 | | | | | | 1 | | 3 | 3 |
| CO2 | 3 | 3 | 1 | 2 | 1 | 3 | | | | | | | 3 | 3 |
| CO3 | 3 | 2 | 3 | 3 | 3 | | | | | | 1 | | 3 | 2 |
| CO4 | 3 | 2 | 2 | 1 | 2 | 3 | | | | | | | 3 | 2 |
| CO5 | 3 | 1 | 2 | 3 | 2 | | | | | | | | 3 | 1 |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**


1. M.K. JAIN, S.R.K. IYENGAR and R.K. JAIN "Numerical methods: for scientific and engineering computation" 2013. 6th ed.,

2. DEVORE, J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning , New Delhi, 8th Edition, 2014.

3. S.C. GUPTA AND V.K. KAPOOR "*Fundamentals of mathematical statistics*" Elevanth thoroughly revised ed., Sultan Chand & Sons educational publishers, New Delhi (June 2003)

4. T. VEERARAJAN, "*Probability, Statistics and Random Processes"* Tata McGraw-Hill Publishing Company Limited, New Delhi(2006)


**REFERENCE BOOKS:**


1. VEERARAJAN.T AND RAMACHANDRAN. T " Numerical Methods with Programming in C" second Ed., Tata Mc. Graw Hill Publishing. Co. Ltd (2007)

2. SANKARARAO.K " Numerical Methods for Scientists and Engineers" - 3rd edition Printice Hall of India Private Ltd. New Delhi-(2007).

3.WALPOLE, R.E., MYERS, R.H., MYERS, S.L. and YE. K., "Probability and Statistics For Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2010.

## EC640907 - DIGITAL ELECTRONICS AND MICROPROCESSOR

| Course Category: Program Core | Course Type: Theory with practical Component | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES:**

To learn the basic methods for the design of digital and microprocessor provide the fundamental concepts used in digital systems and basic microprocessor and its applications.

**UNIT 1: MINIMIZATION TECHNIQUES AND LOGIC GATES** — **6**

Minimization Techniques: Boolean postulates and laws - De-Morgan's Theorem -Principle of Duality - Boolean expression - Minimization of Boolean expressions -Minterm - Maxterm - Sum of Products (SOP) - Product of Sums (POS) –KarnaughmapMinimization - Don't care conditions - Quine-McCluskey method of minimization. Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive–OR and Exclusive-NOR Implementations of Logic Functions using gates, NAND-NOR implementations - Multilevel gate implementations- Multi output gate implementations

**UNIT 2: COMBINATIONAL CIRCUITS AND NUMBER SYSTEMS** — **6**

Design procedure-Half adder -Full Adder -Half subtractor -Full subtractor -Parallel binary adder, parallel binary Subtractor -Carry Look Ahead adder -Serial Adder/Subtractor- BCD adder - Binary Multiplier - Binary Divider- Multiplexer/Demultiplexer -decoder - encoder - parity checker - parity generators - code converters - Magnitude Comparator. Number system and codes:Binary, octal, hexadecimal and decimal Number systems and their inter conversion, BCD numbers (8421-2421), gray code, excess–3 code, cyclic code, code conversion, ASCII, EBCDIC codes. Binary addition and subtraction, signed and unsigned binary numbers, 1's and 2's complement representation.

**UNIT 3: SEQUENTIAL CIRCUITS** — **6**

Latches, Flip-flops - SR, JK, D, T, and Master-Slave - Characteristic table and equation - Application table - Edge triggering - Level Triggering - Realization of one flip flop using other flip flops - Asynchronous Ripple or serial counter -Asynchronous Up/Down counter - Synchronous counters - Synchronous Up/Down counters - Programmable counters - Modulo n counter, Registers - shift registers - Universal shift registers -Shift register counters - Ring counter - Shift counters

**UNIT 4: INTRODUCTION-MICROPROCESSOR** — **6**

Introduction to microprocessor- computer and its organization- Evolution of microprocessor 8085 Microprocessor architecture-Addressing modes- Instruction set- Data transfer Groups-Arithmetic and Logical Group-conditional and Unconditional Group-Interrupts systems-Programming the 8085- Architecture of 8086.Architecture of INTEL 8086 (Bus Interface Unit, Execution unit), register organization, memory addressing, Operating Modes Types. Concept of Pipelining, Memory Segmentation.

**UNIT 5: MICROPROCESSOR PERIPHERAL INTERFACING** — **6**

Introduction, Generation of I/O Ports, Programmable Peripheral Interface (PPI)-Intel 8255, Programmable Keyboard & display (8279), Programmable Interval timers (Intel 8253), UART (8251), D-to-A converter, A-to-D converter, DMA controller , Interrupt controller. Stepper Motor and Actuators.DMA Controller Data Transfer Method,Interface in 8237 /8257.

**List of Experiments**

1. Construct And Implement Circuit For Addition Of Two And Three Binary Numbers
2. Construct And Implement Circuit For Subtraction Of Two And Three Binary Numbers
3. Design And Implementation Of Binary To Gray Code Converter Using Logic Gates
4. Design And Implement Encoder And Decoder Using Logic Gates
5. Design And Implement Of Shift Register Siso Circuits
6. Design And Implement Counter Circuits

**TOTAL: 30+15 =45 PERIODS**

**COURSE OUTCOMES:** At the end of the course, the student should be able to impart knowledge on

CO1: Simplify switching expression using the laws and theorems of Boolean algebra

CO2: Design a minimal two level network of basic gates to realize a given function.

CO3: To outline the formal procedures for the analysis and design of combinational circuits.

CO4: Introduction to microprocessor of 8085 & 8086.

CO5: Microprocessor Peripheral Interfacing 8255,8279 & 8521.

**REFERENCE BOOKS:**


1. Amar K. Ganguly and AnuvaGanguly, "Microprocessors and Microcontrollers: 8085, 8086 and 8051", Alpha Science Intl Ltd, 1st Edition, 2012
2. Donald P.Leach and Albert Paul Malvino, Digital Principles and Applications, 6th Edition, TMH, 2003
3. John F.Wakerly, Digital Design, Fourth Edition, Pearson/PHI, 2006
4. Krishna kant, ,"Microprocessor and Microcontroller" PHI Learning Pvt Ltd, New Delhi, 2nd Edition,2014
5. M. Morris Mano, Digital Design, 4rd Edition, Prentice Hall of India Pvt. Ltd., 2013
6. Mohammed Ali Mazidi and Janice GillispieMazidi, "The 8051 Microcontroller and Embedded Systems", Pearson Education, New Delhi, 2nd Edition, 2008

| CS640205 - **OBJECT ORIENTED PROGRAMMING USING JAVA** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Core** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To learn about Java features
- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the basic principles of inheritance and interfaces
- To develop Java applications with threads and package
- To define exceptions and use I/O streams

| **UNIT 1: INTRODUCTION** | **9** |
|---|---|
| Fundamentals of Object-Oriented Programming - Java Features – Difference between Java and C - Java Environment - Overview of Java Language: Introduction - Simple Java Program - Java Program Structure – Java Tokens – Java statements – Implementing a Java program – Java Virtual Machine – Command line arguments – Constants, variables and Data Types – Operators and Expressions – Branching and Looping | |
| **UNIT 2: BASIC CONSTRUCTS** | **9** |
| Class: Introduction – Defining a Class – Fields Declaration – Methods Declaration – Creating Objects – Accessing Class Members – Constructors – Method Overloading – Static Members – Nesting of Methods – Arrays, Strings and Vectors: Introduction – One-Dimensional Arrays – Creating an Array – Two-Dimensional Arrays – Strings | |
| **UNIT 3: INHERITANCE AND INTERFACES** | **9** |
| Inheritance: Extending a class – Overriding methods – Final Variables and Methods – Final Classes – Finalizer Methods – Abstract Methods and Classes – Visibility Control - Interfaces: Multiple Inheritance: Introduction – Defining Interfaces – Extending Interfaces – Implementing Interfaces – Accessing Interface Variables | |
| **UNIT 4: PACKAGES AND MULTITHREADING** | **9** |
| Packages: – Java API Packages – Using System Packages – Naming Conventions – Creating Packages – Accessing a Package – Using a Package – Adding a Class to a Package – Hiding Classes - Multithreaded Programming: Introduction – Life Cycle of a Thread – Creating Threads – Extending the Thread Class - Implementing the 'Runnable' Interface - Stopping and Blocking a Thread — Using Thread Methods | |
| **UNIT 5: EXCEPTION AND I/O HANDLING** | **9** |
| Exception Handling: Introduction – Types of Errors – Exceptions – Syntax of Exception Handling Code – Multiple Catch Statements – Using Finally Statement – Throwing Our Own Exceptions - Input/output: Introduction – Concept of Streams – Stream Classes – Byte Stream Classes – Character Stream Classes – Handling Primitive Data Types - Simple input and output | |
| **TOTAL: 45 PERIODS** | |

| **COURSE OUTCOMES:** At the end of the course, the student will be able to, |
|---|
| CO1: Understand to implement, compile, test and run Java program |
| CO2: Develop Java programs using OOP principles |
| CO3: Develop Java programs implementing the concepts of inheritance and interfaces |
| CO4: Develop multi-threaded and package Java applications |

CO5:Build Java applications with exception handling and using I/O streams

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 2 | | | | | | | | | 2 | | |
| CO2 | 2 | 2 | | | | | | | | | 2 | | | |
| CO3 | 1 | 2 | 1 | | | | | | | | | 2 | | |
| CO4 | 2 | 1 | | | | | | | | | 1 | 1 | | |
| CO5 | 1 | 2 | 2 | | | | | | | | 2 | 1 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.E. Balagurusamy, "Programming with Java: A Primer", Fourth Edition, First reprint, Tata McGraw Hill, Reprint 2011

**REFERENCE BOOKS:**

1.Herbert Schildt, "Java: A Beginner's Guide", 4th Edition, Tata McGraw Hill, 2007

2.C. Xavier, "Java Programming: A Practical Approach", Tata McGraw Hill, 2011

3.Paul Deitel& Harvey Deitel, "Java How to Program", Eleventh Edition, Pearson Education Ltd. 2017

**WEB RESOURCES:**

1.https://www.mygreatlearning.com/blog/oops-concepts-in-java/

2.https://www.freecodecamp.org/news/object-oriented-programming-concepts-java/

CS640206 - **SOFTWARE ENGINEERING**

| **Course Category: Programme Core** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To understand the basic concepts and principles in software engineering.
- To learn the concept of requirement analysis
- To learn software design techniques.
- To learn software testing methodologies.
- To understand the technologies underlying the software project management

**UNIT 1: SOFTWARE PRODUCT AND PROCESS** **9**

Introduction – Software Engineering Layers – Software Process – Generic Process Model – Prescriptive Process Model: Water Fall Model – Increment Process Model – Prototyping Model – Spiral Model – Concurrent Model. Specialized Process Model: Component Based Development - Formal Methods Model – Aspect Oriented Software Development

**UNIT 2: REQUIREMENT ENGINEERING AND ANALYSIS** **9**

Requirement Engineering Tasks – building requirement Model – Requirement Analysis: Objective(s)s, Rules, Domain Analysis, Requirement modeling Approach, Scenario Based Modeling: Creating, Refining, Writing a Use case. UML Models: Activity Diagram, Swim lane Diagrams. Data Modeling – class Based Modeling

**UNIT 3: DESIGN CONCEPTS AND PRINCIPLES** **9**

Design within the context of Software Engineering - Design Process - Design Concepts – The Design Model – Architecture Model- Architecture Design – Architecture Mapping using Data flow

**UNIT 4: TESTING** **9**

Strategic approach to Software Testing: Verification and Validation. Organizing for software Testing – Software Testing Strategy – Criteria for Completion of Testing. Unit Testing - Integration Testing – Regression Testing – Smoke Testing – Validation Testing – System Testing – The Art of Debugging

**UNIT 5: SOFTWARE PROJECT MANAGEMENT** **9**

Project Management Concepts: Management Spectrum – People – Product – Process – Project. Process and Project Metris – Process Metrics & Software Process improvement – Project Metrics. Software Measurement: Size Oriented Metrics – Function Oriented Metrics – Use case Oriented metrics- WebApp Project Metrics–Empirical Estimation model- COCOMO II Model- Risk Management

**TOTAL: 45 PERIODS**

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

CO1: Understand the basic concepts and life cycle models in software engineering.

CO2: Understand the concept of requirement analysis and various Modeling approaches

CO3:Analyze the various design concepts and understand the architecture mapping with

data flow

CO4: Analyze the different testing strategies and understand the various types of testing

CO5:Understand software metrics, estimation and risk management

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | | | | | | | | 2 | 2 | | |
| CO2 | 1 | 1 | 1 | | | | | | | | 1 | 2 | | |
| CO3 | 1 | 2 | 1 | | | | | | | | 1 | 2 | | |
| CO4 | 2 | 2 | 2 | | | | | | | | 1 | 1 | | |
| CO5 | 2 | 1 | 1 | | | | | | | | 2 | 2 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Roger S. Pressman, "Software Engineering – A practitioner's Approach", Seventh Edition, McGraw-Hill International Edition, 2010

2.Ian Sommerville, "Software Engineering", Ninth Edition

3.Rajib Mall, "Fundamentals of Software Engineering", Fourth Edition, 2014.

**REFERENCE BOOKS:**

1.Watts S.Humphrey, "A Discipline for Software Engineering", Pearson Education, 2007.

2.James F.Peters and Witold Pedrycz, "Software Engineering, an Engineering Approach", Wiley-India, 2007.

3.Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited, 2007.

**WEB RESOURCES:**

1.https://www.ece.rutgers.edu/~marsic/books/SE/links/

2.https://www.edx.org/learn/software-engineering

| CS640303 - **JAVA PROGRAMMING LABORATORY** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Core** | **Course Type: Practical** | **L** | **T** | **P** | **C** |
| | | **0** | **0** | **3** | **1.5** |

**COURSE OBJECTIVES:**

- To develop simple Java programs
- To apply re usability using the concept of inheritance, Package and Interfaces concept to achieve re usability
- To develop applications with appropriate exception handling& Multi-threading
- To implement the concept of Exception Handling.
- To develop a multi-threaded Java program

**LIST OF EXPERIMENTS:**

1. Develop a Java program to generate the first 'N'terms of the Fibonacci sequence
2. Implement a Java program to generate the first 'N' Prime numbers using looping statements
3. Develop a Java program to determine if the given string is a Palindrome or not
4. Develop a Java program to find both the largest and smallest number in a list of integers after arranging them in ascending order
5. Implement a Java program to check if two matrices can be multiplied and perform matrix multiplication if possible. if not display a suitable message
6. Illustrate Function Overloading by:
    a) Swapping Two Integers
    b) Swapping Two Real Numbers
7. Illustrate how Single Inheritance is supported and demonstrate use of method overriding
8. Develop with suitable hierarchy, classes for Point, Shape and Rectangle. Design a simple test application to demonstrate dynamic poly morphism
9. Demonstrate how interfaces are created, implemented and inherited
10. Implement the concept of importing classes from user defined package
11. Develop a multi-threaded Java program with one thread to print all prime numbers below 100 and another to print all Fibonacci numbers less than 100
12. Implement the concept of Exception Handling using predefined and user-defined exceptions

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

CO1: Develop and implement Java programs for simple applications that make use of classes

CO2: Understand the use of inheritance, Package and Interfaces concept to achieve reusability

CO3: Implement Java programs with exception handling& Multi-threading

CO4: Implement the concept of Exception Handling.

CO5:Develop a multi-threaded Java program

**LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS**

**HARDWARE REQUIREMENT:**

- LAN System with 30 nodes (Or) Standalone PCs – 30 Nos.

**SOFTWARE REQUIREMENT:**

- OS - Windows 2000 Professional/XP
- Java IDE (such as Net beans) or JDK 1.6 or above

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 1 | | | | | | | | 1 | 2 | | |
| CO2 | 1 | 2 | 2 | | 2 | | | | | | 2 | | | |
| CO3 | 2 | 1 | 1 | | 1 | | | | | | 2 | 1 | | |
| CO4 | 1 | 2 | 2 | | | | | | | | 1 | 2 | | |
| CO5 | 2 | 2 | 2 | | 2 | | | | | | 2 | 1 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS**

1.E. Balagurusamy, "Programming with Java: A Primer", Fourth Edition, First reprint, Tata McGraw Hill, Reprint 2011

**REFERENCE BOOKS:**

1.Herbert Schildt, "Java: A Beginner's Guide", 4th Edition, Tata McGraw Hill, 2007

2.C. Xavier, "Java Programming: A Practical Approach", Tata McGraw Hill, 2011

**WEB RESOURCES:**

https://www.atri.edu.in/images/pdf/departments/JAVA%20PROGRAMMING%20%20MANUAL.pdf

https://www.atri.edu.in/images/pdf/departments/JAVA%20PROGRAMMING%20%20MANUAL.pdf

| CS640304 - **OFFICE AUTOMATION LABORATORY** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Core** | **Course Type: Practical** | **L** | **T** | **P** | **C** |
| | | **0** | **0** | **3** | **1.5** |

**LIST OF EXPERIMENTS:**

List of Experiments (MS Word)

1. Create a news-paper document withatleast200words,
   a. Usemarginsas,top:1.5,bottom:2,left:2,right:1inches.
   b. Use heading "Gandhi Jayanti", font size: 16, font color: red, font face:ArialBlack.
   c. With first letter "dropped" (use drop cap option) of the first paragraph containing a picture at the right side
   d. Use three columns from these cond paragraph on wards till the half of the page.
   e. Then use heading "Computer basics"
   f. Create paragraph using two columns till the end of the page
2. Create a Mathematical question paper using, at least five equations
   a. With fractions, exponents, summation function
   b. With atleast one,, m*n‟ matrix
   c. Basic mathematical and geometric operators.
   d. Use proper text formatting, page color and page border.
3. Create a flowchart using,
   a. Proper shapes like ellipse, arrows, rectangle, and parallelogram.
   b. Use grouping to group all the parts of the flowchart into one single object.
4. Create a table using table menu with,
   a. Atleast 5 columns and10 rows.
   b. Merge the first row into one cell.
   c. Merge the second row into one cell, then split the second row into three cells.
   d. Use proper table border and color.
   e. Insert proper content into the table with proper text formatting.

5. Create a letter, which must be sent to multiple recipients.
   a. Use Mail-Merge to create the recipient list.
   b. Use excel sheet to enter the recipient.
   c. Start the mail merge using letter and directory format. State the difference.

List of Experiments (MS Excel)

1. Create a table "Student result" with following conditions.
   a. The heading must contain, Sl. No., Name, Mark1, Mark2,Mark3, Total, average and result with manual entry.
   b. Use formulas for total and average.
   c. Find the name of the students who has secured the highest and lowest marks.
   d. Round the average to the nearest highest integer and lowest integer (use ceiling and floor function respectively).
2. Do as directed
   a. Create a notepad file as per the following fields
   b. Import this notepad file into excel sheet using,, data from text‟ option.

c. Grade is calculated as,
    i. If%>=90,thengradeA
    ii. If%>=80 and<90,thengradeB
    iii. If%>=70and <80,thengradeC
    iv. If%>=60 and<70,thengradeD
    v. If%<60,thengradeF

3. Create a sales table using the following data,

| Item | Year1 | Year2 | Year3 | Year4 |
|---|---|---|---|---|
| Item1 | 1000 | 1050 | 1100 | 1200 |
| Item2 | 950 | 1050 | 1150 | 1200 |
| Item3 | 1100 | 1200 | 1200 | 1300 |

a. Draw the bar-graph to compare the sales of the three items for four years using insert option.
b. Draw a line-graph to compare the sales of three items for four years using insert option.
c. Draw different pie-charts for the given data using insert option.
d. Use condition, to highlight all the cells having value >=1000 with redcolor(use conditional formatting).

## List of Experiments (MS Power Point)

1. Create a power-point presentation with minimum 5 slides.
    a. The first slide must contain the topic of the presentation and name of the presentation.
    b. Must contain at least one table.
    c. Must contain at least5 bullets,5numbers.
    d. The heading must be, fontsize:32, font-face: Arial Rounded MT Bold, font-color: blue.
    e. The body must be, fontsize:24, font-face: ComicSans MS, font-color: green.
    f. Last slide must contain,, thank you".
2. Create a power-point presentation with minimum10 slides
    a. Use word art to write the heading for each slides.
    b. Insert atleast one clip-art, one picture
    c. Insert atleast one audio and one video
    d. Hide atleast two slides

## List of Experiments (MSAccess)

1. Create a database "Student" with,
    a. At least one table named "mark sheet" with field name "student name, rollnumber,mark1,mark2,mark3,mark4,total"
    b. The datatypes are, studentname: text, roll number:number, mark1 to mark4:number, total: number. Roll number must be the primary key.
    c. Enter data in the table. The total must be calculated using update query.
    d. Use query for sorting the table according to the descending/ascending order of the total marks.
2. With addition to the table above,
    a. Add an additional field "result"to the "mark sheet "table.
    b. Enter data for atleast 10 students
    c. Calculate the result for all the students using update queries, if

total>=200, then pass, else fail.

d. Search the students, whose name starts with “sh”.
e. Show the names and totalmarks of the students who have passed the examination.

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

CO1: perform documentation

CO2: Create a Mathematical question paper using, at least five equations

CO3: Create a table using the database

CO4: perform accounting operations

CO5:perform presentation skills

**LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS**

**HARDWARE REQUIREMENT:**

- Desktop Systems

**SOFTWARE REQUIREMENT:**

- Windows Operating System.
- MS Office / Libre Office

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | | 2 | | | | | | 1 | 2 | | |
| CO2 | 1 | 2 | 2 | | 1 | | | | | | 2 | | | |
| CO3 | 2 | 1 | | | | | | | | | 2 | 1 | | |
| CO4 | 2 | 1 | 2 | | 2 | | | | | | 1 | 2 | | |
| CO5 | 2 | 2 | 2 | | | | | | | | 2 | 1 | | |

**1- low, 2 - medium, 3 - high, ‘-' no correlation**

**WEB RESOURCES:**

https://pkaiet.in/wp-content/uploads/2020/05/Office-Automation-Lab.pdf

# SEMESTER – V

## CS650207 - COMPUTER NETWORKS AND MANAGEMENT

| Course Category: Programme Core | Course Type: Theory with Practical Component | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES:**

- To understand the concepts of physical layer
- To study the concepts of data link layer
- To introduce function with network layer
- To make the students get familiarized with transport and Application layer
- To understand the principles of network management.

**UNIT 1: INTRODUCTION AND PHYSICAL LAYER** — **6**

Introduction: Data Communication-Network types - Reference models: The OSI reference model – The TCP/IP reference model - The Physical layer: Data and Signals

**UNIT 2: DATA LINK LAYER** — **6**

Introduction to Data link layer- Error detection and correction: Introduction-Block Coding-Cyclic Codes-Checksum –Data Link Control: DLC Services- Framing - Flow and Error control - Connectionless and Connection Oriented-Data Link Layer Protocols: Simple Protocol-Stop and Wait Protocol-HDLC

**UNIT 3: NETWORK LAYER** — **6**

Network layer services – Packet switching – Network layer performance - IPv4: Address space – Classful addressing – Classless addressing – Forwarding of IP packets – Network layer protocols: Internet Protocol – Unicast routing: Introduction - Routing algorithms – Unicast routing protocols

**UNIT 4: TRANSPORT AND APPLICATION LAYER** — **6**

Introduction: Transport Layer Services – Transport layer protocols-Transmission control protocol- Stop and wait protocol – Go back N protocol – Selective repeat
Introduction – Client server programming – Standard client server protocols - Electronic mail: Architecture – Web based email – Telnet: Local Vs Remote Logging

**UNIT 5: NETWORK MANAGEMENT** — **6**

Network Management: Goals, Organization, and Functions, Network and System Management, Network Management System Platform, Current Status and future of Network Management.

**TOTAL: 30 PERIODS**

**LAB EXEPERIMENTS:**

- Implementation of RPC
- Implementation of RMI
- Simulation of Network Management Protocols
- Implementation of PING Service
- Program for Remote Command Execution
- Simulation using Wireshark tool - Analyze the network traffic using Wireshark tools
- Simulation using Packet Tracer - Design a Network using Packet Tracer

**TOTAL : 15 PERIODS**

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

CO1: Understand the basic concepts of Physical Layer and its functions

CO2: Understand the concept of Data Link Layer and its functions

CO3: Analyze the various methods in network layer and its functions.

CO4: Analyze the different techniques on Transport layer & Application layer and its functions

CO5: Understand fundamental goals, organization, and functions of network management

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 2 | | | | | | | | | 2 | 2 | |
| CO2 | 1 | | 2 | | | | | | | | | 2 | 2 | |
| CO3 | 1 | | | | 2 | | | | | | | 2 | 2 | |
| CO4 | 2 | 2 | | | | | | | | | | 2 | 2 | |
| CO5 | 3 | | 3 | | | | | | 1 | | | | 2 | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**I) TEXT BOOKS:**


1. Behrouz A. Forouzan, "Data communication and networking", Fifth Edition, McGraw-Hill Education (India) Pvt. Ltd. 2017
2. Mani Subramanian, Network Management Principles and Practice, 2nd Edition, Pearson Education, 2010


**II) REFERENCE BOOKS:**


1. William S.Stallings, "Data and Computer Communications", 10th Edition, Prentice-Hall, 2013.
2. Tanenbaum and David Wetherall, "Computer Networks", Global Edition, 2021
3. Computer Networking Bible: [3 in 1] The Complete Crash Course to Effectively Design, Implement and Manage Networks. Including Sections on Security, Performance and Scalability, by Rick C. Worley, 2023


**III) AICTE FREE BOOKS:**

Computer Networks: Theory & Practicals, Author Name-Dr. Brijendra Pratap Singh, https://ekumbh.aicte-india.org/allbook.php

**IV) ONLINE LEARNING:**

https://archive.nptel.ac.in/courses/106/105/106105183/

**V) WEB RESOURCES:**

1. https://csc-knu.github.io/sys-prog/books/Andrew%20S.%20Tanenbaum%20-%20Computer%20Networks.pdf

| |
|---|
| 2. https://www.tutorialspoint.com/what-is-network-management |
| **VI) VIRTUAL PLATFORMS** |
| http://vlabs.iitkgp.ac.in/ant/1/ |

| CS650208 - **WEB PROGRAMMING** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Category: Programme Core** | **Course Type: Theory** | | **L** | **T** | **P** | **C** | |
| | | | **3** | **0** | **0** | **3** | |
| **COURSE OBJECTIVES:** | | | | | | | |

- To understand the basics of Web development
- To learn about different frontend development languages
- To understand the concept of backend development and database
- To understand the basics of testing and web hosting
- To learn about the web design

| **UNIT 1: INTRODUCTION TO WEB DEVELOPMENT** | **9** |
|---|---|
| **Internet Basics**: WWW and its evolution- concept of internet-Internet Protocols- browsers – internet explorer, Netscape navigator, opera, Firefox, chrome, Mozilla. search engine, web saver- HTTP and HTTPS protocol - web sessions and cookies | |
| **UNIT 2: FRONTEND DEVELOPMENT** | **9** |
| **HTML5*:*** HTML elements, tags, and attributes- HTML5 Page layout and navigation- Tables, Forms and Media- **CSS Basics & Properties-** CSS syntax, selectors, properties - CSS frameworks – **JavaScript:** JavaScript‟s core concepts, including variables, data types, and control structures – JS DOM – React JS - Jquery | |
| **UNIT 3: BACKGROUND DEVELOPMENT** | **9** |
| **PHP Hyper Text Preprocessor**: syntax and capabilities. **SQL & MySQL:** fundamental component of database management-renowned relational database management system (RDBMS) - Integrating PHP and MySQL - Database Interaction – CRUD Operation – Dynamic web application. **Intro to Programming with the Use of JavaScript:** Functions, closures, and asynchronous programming. - **Testing:** Testing frameworks | |
| **UNIT 4: HOSTING AND DEPLOYMENT** | **9** |
| - **Web Components -** code reusability and maintainability - **Web App Optimizations -** Cross-platform Apps: Mobile application - Desktop application**. Website Structure and Hosting**: Static Websites - Website architecture - domain registration - various web hosting providers. - **Serverless Development:** AWS Lambda or Azure Functions platforms. Software deployment tool – Web hosting - Deploy and Host the Content-Driven Web App | |
| **UNIT 5: WEB DEVELOPMENT CASE STUDIES** | **9** |
| WordPress Web Design - eCommerce Web Design-Small Business Web Design-Mid Market Web Design-Large Business Web Design-Nonprofit Web Design - Spexster Web - BetterCloud - Open Banking - Kitimat Bound - Aspirity Tech | |
| | **TOTAL: 45 PERIODS** |

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

CO1: Understand the basic concepts of Web development.

CO2: Design a HTML, CSS and JavaScript frameworks in web front end development.

CO3: Develop the backend development of an application.

CO4: Analyze the concept of testing frameworks and web hosting.

CO5: Evaluating the different techniques of web development and its application

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | | | | | | | | | | 3 | 1 | |
| CO2 | 2 | 2 | 3 | | 3 | | | | | | | 2 | 2 | |
| CO3 | 2 | 3 | 3 | | 3 | | | | | | | 2 | 2 | |
| CO4 | 2 | | 2 | | 3 | | | | | | | 2 | 1 | |
| CO5 | 2 | 2 | | | 2 | | | | | | | 2 | 2 | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**I) TEXT BOOKS:**


1. Prakash Mahanwar, "WEB PROGRAMMING", UNIVERSITY OF MUMBA, May 2021.
2. John Dean, "Web Programming with HTML5, CSS, and JavaScript", Jones & Bartlett Learning, Jan 2018.


**II) REFERENCE BOOKS:**


1. Chris Bates, "Web Programming Building Internet Applications", Third Edition, Sheffield Hallam University, 2012.
2. Boryana Deliyska,"Introduction to Web Programming", November 2018.
3. John Dean, "Web Programming with HTML, CSS and JavaScript", Jones & Bartlett Learning, Park University, 2019.


**III) WEB RESOURCES:**

1. https://scrimba.com/
2. https://www.w3schools.com/

**IV) AICTE FREE BOOKS:**

1. https://ekumbh.aicte-india.org/allbook.php

**V) ONLINE LEARNING:**

1. https://archive.nptel.ac.in/courses/106/106/106106156/
2. https://www.geeksforgeeks.org/internet-and-web-programming/

| CS650209 - **OBJECT ORIENTED ANALYSIS AND DESIGN** | | | | | |
|---|---|---|---|---|---|
| **Course Category: PC** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To provide a brief, hands-on overview of object-oriented concepts and its life cycle for software development.
- To understand modeling the software and to design them using UML diagrams
- To analyze the problem domain and to identify the objects from the problem specification.
- To develop our ability with how to apply design axioms and corollaries for the classes and object relational systems.
- To inculcate necessary skills to handle open source tools for Computer Aided Software Engineering

**UNIT 1: INTRODUCTION** **9**

An overview – Object basics – Object state and properties – Behaviour – Methods – Messages – Information hiding – Class hierarchy – Relationships – Associations – Aggregations- Identity – Dynamic binding – Persistence – Meta classes – Object oriented system development life cycle.

**UNIT 2: METHODOLOGY AND UML** **9**

Introduction – Survey – Rumbaugh, Booch, Jacobson methods – Unified modelling language – Static and Dynamic models – Rational Rose Suite - UML diagrams – Static diagram : Class diagram – Use case diagrams – Behaviour Diagram : Interaction diagram – State chart diagram – Activity diagram - Implementation diagram: Component diagram – Deployment diagram – example - Design of online railway reservation system using UML diagrams - Dynamic modelling – Model organization – Extensibility.

**UNIT 3: OBJECT ORIENTED ANALYSIS** **9**

Identifying Use case – Business object analysis – Use case driven object oriented analysis – Use case model – Developing effective documentation – Classification – Identifying object, relationships, attributes, methods – Super-sub class – A part of relationships Identifying attributes and methods – Object responsibility – construction of class diagram for generalization, aggregation – example – vehicle class.

**UNIT 4: OBJECT ORIENTED DESIGN** **9**

Design process and benchmarking – Axioms – Corollaries – Designing classes – Class visibility – Refining attributes – Methods and protocols – Object storage and object interoperability – Databases – Object relational systems – Design patterns -Designing interface objects – Macro and Micro level processes – The purpose of a view layer interface-OOUI - MVC Architectural Pattern and Design – Designing the system.

| UNIT 5: CASE TOOLS | 9 |
|---|---|
| Railway domain : Platform assignment system for the trains in a railway station - Academic domain : Student Marks Analysing System - ATM system - Stock maintenance - Quiz System - E-mail Client system - Cryptanalysis – Health Care Systems. Use Open source CASE Tools: StarUML/ UML Graph for the above case studies. | |

**TOTAL: 45 PERIODS**

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

CO1 :Apply object oriented life cycle model for a project.

CO2: Design static and dynamic models using UML diagrams.

CO3: Perform object oriented analysis to identify the objects from the problem specification.

CO4: Identify and refine the attributes and methods for designing the object oriented system.

CO5: Learn the open source CASE tools and to apply them in various domains

**CO PO MAPPING:**

| COs | POs | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 3 | 1 | 1 | 1 | 2 | | | | | 2 | | 3 |
| CO2 | 3 | | 2 | | 2 | | | | | | | 2 |
| CO3 | 3 | 2 | 2 | 2 | 2 | | | | | | | 2 |
| CO4 | 3 | 2 | | | 2 | | | | | 2 | | 1 |
| CO5 | 3 | 1 | 1 | 2 | 2 | | | | | | | 3 |

**I.TEXT BOOKS:**

1.Craig Larman, "Applying UML and Patterns: An Introduction to object- oriented Analysis and Design and iterative development", Third Edition ,Pearson Education, 2012

2. Grady Booch, James Rumbaugh, Ivar Jacobson (2009), The Unified Modeling Language User guide, 2nd edition, Pearson Education, New Delhi, India

**II.REFERENCE BOOKS:**

1. . Ali Bahrami - Object Oriented Systems Development - McGraw Hill International Edition - 2008

2. Cay Horstmann (2004), Object-Oriented Design and Patterns, Wiley India edition, New Delhi, India.

3. Meilir Page-Jones (2000), Fundamentals of Object Oriented Design in UML, Pearson Education and NewYork.

**III.AICTE FREE BOOKS**

https://www.oodesign.com

**IV.ONLINE LEARNING**

**NPTEL** : https://archive.nptel.ac.in/courses/106/105/106105153/

**SPOKEN TUTORIAL**: https://spoken-tutorial.org/tutorial-search/?search_foss=OpenModelica&search_language=English

**V.WEB RESOURCES**

https://link.springer.com/chapter/10.1007/1-85233-856-3_2
https://ieeexplore.ieee.org/document/7474471

CS650305 - **Web Application Development laboratory**

| **Course Category: Programme Core** | **Course Type: Practical** | | **L** | **T** | **P** | **C** | |
|---|---|---|---|---|---|---|---|
| | | | **0** | **0** | **3** | **1.5** | |

**COURSE OBJECTIVES:**

- To understand the basic concepts of HTML tags
- To learn how to embedded CSS and JS with HTML
- To understand the concepts of React JS
- To understand the usage of JQuery.
- To learn about application development with database

**Pre-requisites, if any:** Basic Knowledge about Web development

**LIST OF EXPERIMENTS:**

1. Create a simple web site for your college. Use various basic formatting tags, Hyperlinks, lists, tables and frames.
2. Develop static pages (using only HTML) of an online Book store. The website should consist of the following pages. Home page, Registration and user Login, Books catalog, Shopping cart, Payment by credit card, order Confirmation.
3. Create a webpage using HTML.
   I. To embed an image map in a web page.
   II. To fix the hot spots.
   III. Show all the related information when the hotspots are clicked.
4. Write a program to create a website using HTML, CSS and JavaScript
5. Write a program to build a Chat module using HTML CSS and JavaScript
6. Create a Simple Login form using Reactjs
7. Write a program to create a simple calculator Application using React JS
8. Write a program to create a voting application using React JS
9. Write a program to create and Build a Password Strength Check using Jquery
10. Create a project on Grocery delivery application
11. Connecting our TODO React JS Project with Firebase

**TOTAL: 45 PERIODS**

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

CO1: Understand the various HTML tags for creating website.

CO2: Implement a program with HTML, CSS and JavaScript.

CO3: Implement a program by using React JS.

CO4: Create web application with validation.

CO5: Create a web or mobile application and launching concept.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 2 | | 1 | | | | | | | 1 | 1 | |
| CO2 | 2 | 2 | 2 | | 1 | | | | | | | 2 | 2 | |
| CO3 | 2 | 3 | 3 | | 2 | | | | | | | 2 | 2 | |
| CO4 | | 3 | 2 | | 2 | | | | | | | 3 | 3 | |
| CO5 | 2 | 2 | 2 | | 3 | | | | | | | 3 | 3 | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**Hardware Requirements:**

- Processor: Recommended 2GHz or more
- Ethernet connection (LAN)
- Hard Drive: 64 GB or more
- Memory (RAM): 4 GB or above

**Software Requirements:**

- Windows Operating System.
- Web Browser: Google Chrome
- MySQL Server (back-end)

**I) TEXT BOOKS:**


1. Prakash Mahanwar, "WEB PROGRAMMING", UNIVERSITY OF MUMBA, May 2021.
2. John Dean, "Web Programming with HTML5, CSS, and JavaScript", Jones & BartlettLearning, Jan 2018.


**II) REFERENCE BOOKS:**


1. Chris Bates, "Web Programming Building Internet Applications", Third Edition, Sheffield Hallam University, 2012.
2. Boryana Deliyska,"Introduction to Web Programming", November 2018.
3. John Dean, "Web Programming with HTML, CSS and JavaScript", Jones & Bartlett Learning, Park University, 2019.


**III) WEB RESOURCES:**

1. https://mrcet.com/pdf/Lab%20Manuals/Full%20Stack%20Lab.pdf
2. https://mjcollege.ac.in/documents/wp-lab-manual.pdf

**IV) VIRTUAL PLATFORM:**

1. https://fliplet.com/blog/9-web-application-development-platforms-to-build-a-free-web-app/
2. https://www.zoho.com/creator/application-development/web.html
3. https://code.org/educate/weblab

CS650306 - **OBJECT ORIENTED ANALYSIS AND DESIGN LABORATORY**

| **Course Category: PC** | **Course Type: Practical** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **0** | **0** | **3** | **1.5** |

**COURSE OBJECTIVES:**

- To identify a real world problem and develop requirements specification document
- To provide the necessary knowledge and skills in using object-oriented CASE tools.
- To learn to write test cases and to draw the use-case diagrams and Design process.
- To identify and refine the attributes and methods for designing the object orientedsystem.
- To learn the open source CASE tools and to apply them in various domains

**LIST OF EXPERIMENTS**

1. Passport automation system.
2. Book bank
3. Exam Registration
4. Stock maintenance system.
5. Online course reservation system
6. E-ticketing
7. Online Quiz
8. e-book management system
9. Recruitment system
10. Foreign trading system

**TOTAL: 45 PERIODS**

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

CO1: Create software requirements specification document for a real world problem

CO2: Apply UML to design static and dynamic model for the solution

CO3: Apply appropriate design patterns and create code from design.

CO4: Identify and refine the attributes and methods for designing the object oriented system.

CO5: Test the product to meet the identified requirements

**CO PO MAPPING:**

| **COs** | **POs** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 3 | 1 | 1 | 1 | 2 | | | | | 2 | | 3 |
| CO2 | 3 | | 2 | | 2 | | | | | | | 2 |
| CO3 | 3 | 2 | 2 | 2 | 2 | | | | | | | 2 |
| CO4 | 3 | 2 | | | 2 | | | | | 2 | | 1 |
| CO5 | 3 | 1 | 1 | 2 | 2 | | | | | | | 3 |

**Hardware/Software Required for a Batch of 30 Students**

Hardware

- LAN System with 30 nodes(OR)Stand alone PCs−30 Nos.

Software Tools:

- OS–Windows 2000 Professional / XP , Windows 7 or Higher Visual

| |
|---|
| Paradigm, Visual case and Rational Suite<br>• ArgoUML ,<br>• Selenium ,<br>• JUnit or Apache JMeter<br>• Eclipse IDE JUnit |
| **I.TEXT BOOKS:** |
| 1.Craig Larman, "Applying UML and Patterns: An Introduction to object- oriented Analysis and Design and iterative development", Third Edition ,Pearson Education, 2012 |
| 2.Grady Booch, James Rumbaugh, Ivar Jacobson (2009), The Unified Modeling Language User guide, 2nd edition, Pearson Education, New Delhi, India |
| **II.REFERENCE BOOKS:** |
| 1.Ali Bahrami, "Object Oriented System Development", McGraw Hill International Edition, 2008 . |
| 2.Brahma Dathan, Sarnath Ramnath, "Object-Oriented Analysis, Design and Implementation", Universities Press, 2010 |
| 3.Cay Horstmann (2004), Object-Oriented Design and Patterns, Wiley India edition, New Delhi, India. |
| **III.ONLINE LEARNING** |
| **NPTEL** : https://archive.nptel.ac.in/courses/106/105/106105153/ |
| **SPOKEN TUTORIAL**: https://spoken-tutorial.org/tutorial-search/?search_foss=OpenModelica&search_language=English |
| **IV.WEB RESOURCES** |
| https://link.springer.com/chapter/10.1007/1-85233-856-3_2<br>https://ieeexplore.ieee.org/document/7474471 |
| **V.VIRTUAL PLATFORM** |
| https://online.visual-paradigm.com/diagrams/features/uml-tool/ |

| CS650503 - INTEGRATED APTITUDE SKILLS - I (HIGHER) | | | | | |
|---|---|---|---|---|---|
| Course Category: EEC | Course Type:Skill Based Course | L | T | P | C |
| | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES:**

**To impart knowledge on the following Topics,**

- Solve aptitude, logical and questions.
- Excel the talents of students in logical Verbal reasoning Analysis
- The non-verbal Reasoning Analysis
- enable the students to speak and write in English without making any mistakes
- Excel the students in mock interview, group discussion.

| **UNIT 1: QUANTITATIVE APTITUDE** | **6** |
|---|---|

Percentage - Ratio & Proportions - Pipes & Cisterns - Permutations & Combinations - Partnership - Allegation (Or) Mixture - Races & Games - Stocks & Shares - Height & Distance - True Discount & Banker‟s Discount - Probability - Mensuration (Area, Volume & Surface Area) - Interest (Simple Interest, Compound Interest) - Logarithm - Chain Rule - Data Interpretation (Tabulation, Bar Chart, Pie Chart, Line Graphs)

| **UNIT 2: LOGICAL REASONING- VERBAL REASONING** | **6** |
|---|---|

Logic - Statement – Argument, Assumptions, Courses of action, Conclusion - Deriving Conclusion from passages - Theme Detection - Cause and Effect reasoning

| **UNIT 3: LOGICAL REASONING- NONVERBAL REASONING:** | **6** |
|---|---|

Series - Analogy - Classification - Analytical Reasoning - Mirror Images - Water Images - Spotting out the embedded figures - Completion of incomplete patterns - Figure Matrix - Paper Folding - Paper Cutting - Rule Detection - Grouping of identical figures - Cubes and Dice - Dot Situation - Construction of squares and triangles - Figure formation and analysis

| **UNIT 4: VERBAL ABILITY** | 6 |
|---|---|

Concord - Cloze Passage - Analogies or Reverse Analogies - Jumbled Sentences - Error Deduction - Reading Comprehension - Paragraph Formation - Completing Statements - Usage of Prepositions - Inference - Verification of Truth from the Statements - Change of Speech

| **UNIT V: PRACTICALS** | **6** |
|---|---|

Extempore speech, Group Discussion, Mock Interview

**TOTAL: 30 PERIODS**

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

| | |
|---|---|
| CO1 | Understand the basic concepts of quantitative ability. |
| CO2 | Understand the basic concepts of verbal logical reasoning Skills. |

| | |
|---|---|
| CO3 | Acquire satisfactory competency in use of nonverbal reasoning. |
| CO4 | Understand the concepts in verbal ability |
| CO5 | Acquire satisfactory competency in Group Discussion and Mock Interview |

CO-PO MAPPING

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | - | - |
| CO2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | - | - |
| CO3 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 1 | - | - |
| CO4 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 1 | 2 | - | - |
| CO5 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | - | - |

1- Low, 2 - Medium, 3 - High, „-' No Correlation

**I) TEXT BOOKS:**

1. Legal Reasoning for CLAT, AILET, SLAT & Other Law Entrance Exams (3rd Edition, 2022) by Disha Experts, Disha Publications, ISBN: 9789355642219
2. Quantitative Aptitude for Competitive Examinations (2023 Edition) by R.S. Aggarwal, S.Chand & Company Pvt. Ltd.

**II) REFERENCE BOOKS:**

1. Quantitative Aptitude for Competitive Examinations (2023 Edition) by Anand P. A., Wiley India Pvt. Ltd..
2. How to Crack Test of Reasoning: In All Competitive Exams (2023 Edition) by Jaikishan and Premkishan, Arihant Publications India Limited

**III) AICTE FREE BOOKS :**

https://free.aicte-india.org/Quantitative-Aptitude-Basics.php

**IV) ONLINE LEARNING:**

NPTEL: Developing Soft Skills and Personality (NPTEL)
https://nptel.ac.in/courses/109104107

**V) WEB RESOURCES:**

Aptitude Skills
1. https://www.udemy.com/course/quant_aptitud_tricks_and_shortcuts
Reasoning
2. https://aptitudeclass.com/
Practical Aptitude tests
3. http://www.practiceaptitudetests.com/

| CS650801 - **IT PROJECT MANAGEMENT** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Category: Programme Mandatory** | **Course Type: Theory** | | **L** | **T** | **P** | **C** | |
| | | | **2** | **0** | **0** | **0** | |
| **COURSEOBJECTIVES:** | | | | | | | |

1. To effectively plan, manage, execute, and control projects within the stipulated time
2. To effectively manage cost targets with a focus on Information Technology and Service Sector
3. To understand various agile project management techniques such as Scrum and DevOps.
4. To Learn the Various terminologies used in Scrum.
5. To Understand the Devops Concepts.

| **UNIT1:Project Overview and Project Scheduling** | **6** |
|---|---|

Project Identification, Market and Demand Analysis, Project Cost Estimate, Financial Appraisal., Project Scheduling, Introduction to PERT and CPM, Critical Path Calculation, Precedence Relationship, Difference between PERT and CPM, Float Calculation and its importance, Cost reduction by Crashing of activity.

| **UNIT2: Cost Control and Project Management Features** | **6** |
|---|---|

Project Cost Control (PERT/Cost), Resource Scheduling & Resource Levelling, Risk Analysis, Project Control, Project Audit and Project Termination.

| **UNIT3Agile Project Management** | **6** |
|---|---|

Introduction, Agile Principles, Agile methodologies, Relationship between Agile Scrum, Lean, DevOps and IT Service Management (ITIL).

| **UNIT4: Scrum** | **6** |
|---|---|

Various terminologies used in Scrum (Sprint, product backlog, sprint backlog, sprint review, retro Perspective), various roles (Roles in Scrum), Best practices of Scrum.

| **UNIT5: DevOps** | **6** |
|---|---|

Overview and its Components, Containerization Using Docker, Managing Source Code and Automating Builds, Automated Testing and Test-Driven Development, Continuous Integration, Configuration Management, Continuous Deployment, Automated Monitoring, Other Agile Methodologies: Introduction to XP, FDD, DSDM, Crystal.

**TOTAL: 30 PERIODS**

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

CO1:Uunderstand Project Management activities and to identify basic project management skills with a strong emphasis on issues and problems associated with delivering successful IT projects.

CO2: Develop activity network to use PERT and to manage project risks such as Resource scheduling and cost control.

CO3:Classify the concept of Agile Project Management and IT Service Management.

CO4:Apply the various terminologies and best practices followed in scrum.

CO5:Identify the concept of Devops and its Working, Automated testing and test-driven methods and continuous deployment.

**CO-POMAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | 2 | 2 | 2 | | | | 1 | 2 | 2 | 3 | 2 | |
| CO2 | 2 | 1 | 2 | 1 | 2 | | | | 1 | 2 | 3 | 3 | 2 | |
| CO3 | 2 | 2 | 2 | 1 | 2 | | | | 2 | 2 | 3 | 3 | 2 | |
| CO4 | 1 | 2 | 2 | 1 | 2 | | | | 2 | 2 | 3 | 3 | 1 | |
| CO5 | 2 | 2 | 2 | 2 | 2 | | | | 2 | 2 | 3 | 3 | 2 | |

**1-low,2-medium,3- high, "-" No Correlation**

**I. TEXTBOOKS:**

1.Mike Cohn, Succeeding with Agile: Software Development Using Scrum, 2015, 1stEdition Addison-Wesley Professional.

2.Software Project Management: A Concise Study, KELKAR, S. A,Edition : THIRD EDITION

**II. REFERENCE BOOKS:**

1.Roman Pichler, Agile Product Management with Scrum: Creating Products that Customers Love,
2.2011, First edition , Addison-Wesley.
2.Schwaber, Agile Project Management with Scrum, 2014,1st edition, Microsoft Press US.
3.Ashish K. Bhattacharya, Principles & Practices of Cost Accounting, A. H. Wheeler publisher

**III. AICTE FREE BOOKS**

1.https://ekumbh.aicte-india.org/book.php#

**IV. ONLINE LEARNING**

https://onlinecourses.nptel.ac.in/noc24_mg01/preview

**V. WEB RESOURCES**

1.https://www.mindtools.com/

2.https://www.projectmanager.com/guides/it-project-management

# SEMESTER – VI

| CS660210 - **COMPUTER GRAPHICS AND MULTIMEDIA** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Core** | **Course Type: : Theory with practical Component** | **L** | **T** | **P** | **C** |
| | | **2** | **0** | **2** | **3** |

**COURSE OBJECTIVES:**

- To learn 2D transformation objects
- To understand the concepts of 3D objects and color models
- To know the basics of multimedia system
- To know the concepts of compression techniques and multimedia technologies
- To understand the basic concepts of related to hypermedia in multimedia systems

| | |
|---|---|
| **UNIT 1:** OUTPUT PRIMITIVES | **6** |
| Basic − Line − Curve and ellipse drawing algorithms − Attributes − TwoDimensional geometric transformations − Two-Dimensional clipping and viewing – Input techniques. | |
| **UNIT 2:** THREE-DIMENSIONAL CONCEPTS | **6** |
| Three-Dimensional object representations − Three-Dimensional geometric and modeling Transformations − Three-Dimensional viewing − Hidden surface elimination − Color models − Animation. | |
| **UNIT 3:** MULTIMEDIA SYSTEMS DESIGN | **6** |
| Multimedia basics − Multimedia applications − Multimedia system architecture − Evolving technologies for multimedia − Defining objects for multimedia systems − Multimedia data interface standards − Multimedia databases. | |
| **UNIT 4:** MULTIMEDIA FILE HANDLING | **6** |
| Compression and decompression − Data and file format standards − Multimedia I/O technologies − Digital voice and audio − Video image and animation − Full motion video − Storage and retrieval technologies. | |
| **UNIT 5:** HYPERMEDIA | **6** |
| Multimedia authoring and user interface − Hypermedia messaging − Mobile messaging − Hypermedia message component − Creating hypermedia message − Integrated multimedia message standards − Integrated document management − Distributed multimedia systems. | |
| **TOTAL: 30 PERIODS** | |

**LIST OF EXPERIMENTS**

1. To implement Bresenham‟s algorithms for line, circle and ellipse drawing.
2. To perform 2D Transformations such as translation, rotation, scaling, reflection and sharing.
3. To implement Cohen-Sutherland 2D clipping and window-viewport mapping.
4. To perform 3D Transformations such as translation, rotation and scaling.
5. To visualize projections of 3D images and Hidden Surface Elimination.
6. To convert between color models.
7. To implement text compression algorithm.
8. To implement image compression algorithm.
9. To perform animation using any Animation software.
10. To perform basic operations on image using any image editing software.

**TOTAL: 15 PERIODS**

**TOTAL: 30+15=45 PERIODS**

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

CO1: Recognize the 2D transformation objects

CO2: Understand the concepts of 3D objects and color models

CO3: Implement the multimedia system

CO4: Differentiate compression techniques and multimedia technologies

CO5: Asses the basic concepts of related to hypermedia in multimedia systems

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | 1 | | | | | | | | | 2 | 2 | |
| CO2 | 3 | 3 | 3 | 2 | 2 | | | | | | | 2 | 2 | |
| CO3 | 3 | 3 | 3 | 2 | 3 | | | | | | 2 | 2 | 2 | |
| CO4 | 2 | 2 | 2 | 2 | 3 | | | | | | 2 | 2 | 2 | |
| CO5 | 3 | 2 | 2 | 2 | 3 | | | | | | 2 | 2 | 2 | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**I. TEXT BOOKS:**

1. Donald Hearn, M. Pauline Baker and warren carithers, "Computer Graphics with open GL", Pearson Education, 2013.

2. Donald Hearn, M. Pauline Baker, " Computer Graphics C version" , Pearson Education, 2014

**II. REFERENCE BOOKS:**

1. John F Hughes;Andries Van Dam;Morgan McGuire;David F Sklar;James D Foley;Steven K Feiner;Kurt Akeley , "Computer graphics Principles and Practice": Third Edition, 2018

2. Atul P.Godse and Deepali A.Godse , "Computer Graphics and Multimedia", Technical Publication,2019.

3. Jeffrey McConnel, Computer Graphics: Theory into Practice, Jones and Bartlett Publishers, 2006.

**III. AICTE FREE BOOK**

1. https://www.aicteindia.org/sites/default/files/bvoc/Graphics%20&%20Multimedia.pdf

**IV. ONLINE LEARNING**

1. https://www.classcentral.com/subject/computer-graphics
2. https://archive.nptel.ac.in/courses/106/102/106102065/

**V. WEB RESOURCE**

1. https://www.reddit.com/r/GraphicsProgramming/comments/iiveq7/computer_graphics_learning_resources/?rdt=41391

| CS660211 - CLOUD TECHNOLOGY | | | | | | |
|---|---|---|---|---|---|---|
| Course Category: Programme Core | Course Type: : Theory | L | T | P | C | |
| | | 3 | 0 | 0 | 3 | |

**COURSE OBJECTIVES:**

- To introduce the broad perceptive of cloud architecture and model
- To understand the concept of Virtualization and design of cloud Services
- To provide the security & risk management of cloud Computing system
- To apply different cloud programming model as per need.
- To be familiar with the lead players in cloud.

| **UNIT 1: CLOUD ARCHITECTURE AND MODEL** | **9** |
|---|---|

. Technologies for Network-Based System – System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture. Cloud Models:- Characteristics– Cloud Services – Cloud models (IaaS, PaaS, SaaS) – Public vs Private Cloud –Cloud Solutions - Cloud ecosystem – Service management – Computing on demand.

| **UNIT 2: VIRTUALIZATION** | **9** |
|---|---|

Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Virtual Clusters and Resource management – Virtualization for Data-center Automation - Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development.

| **UNIT 3: SECURITY IN THE CLOUD** | **9** |
|---|---|

Security Overview – Cloud Security Challenges and Risks – Software-as-a-Service Security– Security Governance – Risk Management – Security Monitoring – Security Architecture Design – DataSecurity – Application Security – Virtual Machine Security – Identity Management and Access Control – Autonomic Security.

| **UNIT 4: PROGRAMMING MODEL** | **9** |
|---|---|

Parallel and Distributed Programming Paradigms – MapReduce, Twister and Iterative MapReduce – Hadoop Library from Apache – Mapping Applications - Programming Support - Google App Engine, Amazon AWS - Cloud Software Environments -Eucalyptus, Open Nebula, OpenStack, Aneka, CloudSim.

| **UNIT 5: CASE STUDIES** | **9** |
|---|---|

Software as a Service (SaaS) - Big Data Analytics -Software-Defined Wide Area Networking (SD-WAN) - Private/Public/Hybrid Cloud - Infrastructure as a Service (IaaS) -Test and Development- Virtual Desktops (VDI) / Desktop as a Service (DaaS)-Email-Disaster Recovery as a Service (DRaaS)- Backup as a Service (BaaS)

**TOTAL: 45 PERIODS**

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

CO1: Identify the architecture, infrastructure and delivery models of cloud computing

CO2: Apply suitable virtualization concept

CO3: Address the core issues of cloud computing such as security, privacy andinteroperability

CO4: Choose the appropriate cloud player, Programming Models and approach.

CO5: Design Cloud Services and Set a private cloud

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | | | 1 | | | | | 1 | | 2 | 2 | 1 |
| CO2 | | 2 | 2 | | 1 | | | | | 2 | | 2 | 1 | 1 |
| CO3 | | 1 | | 3 | 2 | | | | | 1 | | 2 | 1 | 2 |
| CO4 | | 2 | | 3 | 2 | | | | | 2 | | 2 | 2 | 1 |
| CO5 | | 1 | | 2 | 2 | | | | | 1 | | 2 | 1 | 2 |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**I) TEXT BOOKS:**

1. **"**Cloud Computing: Concepts, Technology, Security & Architecture" by Thomas Erl , The Pearson Digital Enterprises Series , Oct 2023.
2. "Cloud Computing", by Kris Jamsa, The Jones & Bartlett Learning, Mar 2022.

**II) REFERENCE BOOKS:**

1. TobyVelte,AnthonyVelte,RobertElsenpeter,"CloudComputing,APracticalApproach", July 2017.
2. "Mastering Cloud Computing", by Buyya, Vecchiola, Selvi, July 2017.
3. "Grid And Cloud Computing", by D Janakiram (Author), Jan 2016.

**III) AICTE FREE BOOK**

1. Essentials of Cloud Computing, K. Chandrasekaran
2. Cloud Computing, Pandey & Choudhary

**IV) ONLINE LEARNING**

https://onlinecourses.nptel.ac.in/noc21_cs14/preview

**V) WEB RESOURCE**

1. http://tagoreiet.ac.in/uploads/corner/qbcse/CS8711.pdf
2. https://www.researchgate.net/publication/277860117_Cloud_Computing

CS660212 - **Machine Learning**

| **Course Category: Program Core** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To understand the basic concepts of machine learning
- To understand and build supervised learning models
- To understand and build unsupervised learning models
- To evaluate the algorithms based on corresponding metrics identified

| **UNIT I** | **INTRODUCTION TO MACHINE LEARNING** | **9** |
|---|---|---|

Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik- Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off

| **UNIT II** | **SUPERVISED LEARNING** | **9** |
|---|---|---|

Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Perceptron algorithm, Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random Forests

| **UNIT III** | **ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING** | **9** |
|---|---|---|

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization

| **UNIT IV** | **NEURAL NETWORKS** | **9** |
|---|---|---|

Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout

| **UNIT V** | **DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS** | **9** |
|---|---|---|

Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms – t test, McNemar's test, K-fold CV paired t test

**TOTAL: 45 PERIODS**

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

**CO1:** Explain the basic concepts of machine learning.

**CO2:** Construct supervised learning models

**CO3:** Construct unsupervised learning algorithms.

**CO4:** Evaluate and compare different models.

**CO5:** Analysis of classification algorithms

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | 2 | 1 | 3 | | 1 | | | 1 | 1 | 2 | 1 |
| CO2 | 2 | 2 | 3 | 2 | 1 | 3 | | 1 | | | 2 | 1 | 1 | 1 |
| CO3 | 2 | 2 | 3 | 2 | 1 | 3 | | 1 | | | 1 | 1 | 2 | |
| CO4 | 2 | 3 | 3 | 2 | 3 | 3 | | 1 | | | 1 | 2 | 1 | 1 |
| CO5 | 2 | 2 | 2 | | 1 | | | 1 | | | 2 | 1 | 2 | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**I) TEXT BOOKS:**


1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRC Press, 2014


**II) REFERENCE BOOKS:**


1. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997

2. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, 2012, 2018

3. Sebastain Raschka, Vahid Mirjalili , "Python Machine Learning", Packt publishing 3rd Edition, 2019


**III) ONLINE LEARNING:**

1. https://archive.nptel.ac.in/courses/106/106/106106139/g

**IV) WEB RESOURCES :**

1. https://faculty.ucmerced.edu/mcarreira-perpinan/teaching/CSE176/lecturenotes.pdf

2. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SIT1305.pdf

| CS660307 - **CLOUD TECHNOLOGY LABORATORY** | | | | | |
|---|---|---|---|---|---|
| Course Category: Programme Core | Course Type: : Practical | **L** | **T** | **P** | **C** |
| | | **0** | **0** | **3** | **1.5** |

**COURSE OBJECTIVES:**

- To develop the concept of Virtualization and design of cloud Services
- To develop web applications in cloud.
- To learn the design and development process involved in creating a cloud based application.
- To simulate a cloud environment to implement new schedulers.
- To develop Hadoop single node cluster and run simple applications.

**LIST OF EXPERIMENTS**

1. Install Virtual box/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
8. Install Hadoop single node cluster and run simple applications like wordcount

**TOTAL : 45 PERIODS**

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

CO1: Configure various virtualization tools such as Virtual Box, VMware workstation.

CO2: Design and deploy a web application in a PaaS environment.

CO3: Learn how to simulate a cloud environment to implement new schedulers.

CO4: Manipulate large data sets in a parallel environment.

CO5: Install and use a generic cloud environment that can be used as a private cloud

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | | | 1 | | | | | 1 | | 2 | 2 | 1 |
| CO2 | | 2 | 2 | | 1 | | | | | 2 | | 2 | 1 | 1 |
| CO3 | | 1 | | 3 | 2 | | | | | 1 | | 2 | 1 | 2 |
| CO4 | | 2 | | 3 | 2 | | | | | 2 | | 2 | 2 | 1 |
| CO5 | | 1 | | 2 | 2 | | | | | 1 | | 2 | 1 | 2 |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**I) TEXT BOOKS:**

1. **"**Cloud Computing: Concepts, Technology, Security & Architecture**"** by Thomas Erl , The Pearson Degital Enterprise Series , Oct 2023.
2. **"**Cloud Computing A Practical Approach**"** by Toby Velte , Anthony Velte, Robert Elsenpeter ,Jul 2017.

**II) REFERENCE BOOKS:**

1. "Cloud and Distributed Computing: Algorithms and Systems", by RajivMisra, Yashwant Singh Patel , Kindle Edition, April 2020.
2. "Cloud Computing: Theory and Practice", by Dan C. Marinescu, 2nd Edition Nov 2017.
3. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, Fourth Edition, 2015.

**III) VIRTUAL PLATFORMS:**

https://cloudlabs.ai/virtual-labs

| CS660308 - **Machine Learning Laboratory** | | | | | | |
|---|---|---|---|---|---|---|
| **Course Category: Programme Core** | **Course Type: Practical** | **L** | **T** | **P** | **C** | |
| | | **0** | **0** | **3** | **1.5** | |

**COURSE OBJECTIVES:**

- Learning basic concepts of Python through illustrative examples and small exercises.
- To prepare students to become Familiarity with the Python programming in¬ AI environment
- To provide student with an academic environment aware of various AI¬ Algorithms.
- To train Students with python programming as to comprehend, analyze,¬ design and create AI platforms and solutions for the real life problems

**LIST OF EXPERIMENTS:**

1. Write a python program to import and export data using Pandas library functions
2. Demonstrate various data pre-processing techniques for a given dataset
3. Implement Dimensionality reduction using Principle Component Analysis (PCA) method
4. Write a Python program to demonstrate various Data Visualization Techniques
5. Implement Simple and Multiple Linear Regression Models
6. Develop Logistic Regression Model for a given dataset
7. Develop Decision Tree Classification model for a given dataset and use it to classify a new sample.
8. Implement Naïve Bayes Classification in Python
9. Build KNN Classification model for a given dataset.
10. Build Artificial Neural Network model with back propagation on a given dataset.
11. Implement Random forest ensemble method on a given dataset and Implement Boosting ensemble method on a given dataset
12. Write a python program to implement K-Means clustering Algorithm

**Total: 45 Periods**

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

CO1: Apply various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction,)

CO2: Understand the fundamentals of knowledge representation, inference.

CO3: Understand the fundamentals of theorem proving using AI tools.

CO4: Demonstrate working knowledge of reasoning in the presence of incomplete information

CO5: Demonstrate working knowledge of reasoning in the presence of uncertain information

**LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS**

**HARDWARE REQUIREMENT:**

- l Desktop Systems - Pentium IV with 2 GB RAM
- 160 GB HARD Disk
- Monitor 1024 x 768 color

**SOFTWARE REQUIREMENT:**

- Operating systems: Windows* 7 or later, macOS, and Linux.
- Python* versions: 2.7.X, 3.6.X.,3.8.X

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 1 | 2 | 1 | 3 | | 1 | | | 1 | 1 | 2 | 1 |
| CO2 | 2 | 2 | 1 | 2 | 1 | 2 | | 1 | | | 2 | 1 | 1 | 1 |
| CO3 | 1 | 2 | 2 | 2 | 1 | 3 | | 1 | | | 1 | 1 | 2 | |
| CO4 | 2 | 1 | 3 | 2 | 1 | 1 | | 1 | | | 1 | 2 | 1 | 1 |
| CO5 | 1 | 2 | 2 | | 1 | | | 1 | | | 2 | 1 | 2 | |

**I) TEXT BOOKS:**


1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRC Press, 2014


**II) REFERENCE BOOKS:**


1. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997
2. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, 2012, 2018
3. Sebastain Raschka, Vahid Mirjalili , "Python Machine Learning", Packt publishing 3rd Edition, 2019


**III) VIRTUAL PLATFORM:**

1. https://python-iitk.vlabs.ac.in/

## CS660504-TRAINING IN IOT USING ARDUINO

| Course Category: EEC | Course Type: Theory | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES:**

- To program Arduino to control lights, motors, and other devices
- To learn Arduino's architecture, including inputs and connectors for add-on devices.
- To add third-party components such as LCDs, accelerometers, gyroscopes, and GPS trackers to extend Arduino's functionality.
- To understand various options in programming languages, from C to drag-and-drop languages
- To test, debug, and deploy the Arduino to solve real world problems.

**FUNDAMENTALS OF IoT** **9**

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack– Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects, Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming

**LIST OF EXERCISES**

1.Controlling the light Emitting Diode(LED) with a Push button.
2.Interfacing the RGB LED with the Arduino.
3.Controlling the LED blink rate with the Potentiometer interfacing with Arduino.
4.Detection of the light using photo register.
5.Interfacing of temperature sensor LM35 with arduino.
6.Interfacing servo motor with the arduino
7.Interfacing of the Active buzzer and relay with arduino

**TOTAL: 30 PERIODS**

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

CO1- Recall the basics of sensors, its functioning.

CO2- Execute basic and advanced assembly language programs.

CO3- Learn the ways to interface I/O devices with processor for task sharing.

CO4- Illustrate the basics of co-processor and its ways to handle float values by its instruction set.

CO5- propose the functionality of micro controller, latest version processors and its applications

CO-PO MAPPING

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | 1 | | 1 | | | | 1 | 1 | 1 | 2 | 1 | 3 |
| CO2 | 2 | | 1 | | 2 | | | | 2 | 1 | 2 | 1 | 1 | 3 |
| CO3 | 1 | | 1 | | 2 | | | | 2 | 1 | 2 | 1 | 1 | 3 |
| CO4 | 1 | | 2 | | 3 | | | | 2 | 1 | 2 | 2 | 1 | 3 |
| CO5 | 3 | | 2 | | 1 | | | | 2 | 1 | 3 | 1 | 1 | 3 |

**1- low, 2 - medium, 3 - high, '-' no correlation**

## I. TEXT BOOKS:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017
2. "Practical Internet of Things Security", Brian Russell Drew Van Duren, Packt Publishing, 2016

## II. REFERENCE BOOKS:

1. Kamal, R., "Internet of Things – Architecture and Design Principles," 1st Edition, McgrawHill,2017.
2. Simone Cirani," Internet of Things- Architectures, Protocols and Standards", WILEY,2018
3. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖, Universities Press, 2015.

## III. AICTE FREE BOOK

1. https://books.google.co.in/books?id=L6YEEAAAQBAJ&printsec=frontcover#v=onepage&q&f=false

## IV. ONLINE LEARNING

1. https://onlinecourses.nptel.ac.in/noc24_cs35/preview
2. https://elearn.nptel.ac.in/shop/iit-workshops/completed/internet-of-things-iot-batch-2/?v=c86ee0d9d7ed

## V. WEB RESOURCE:

1. https://online.stanford.edu/courses/xee100-introduction-internet-things

# PROGRAMME ELECTIVES

# VERTICAL I
# FULL STACK DEVELOPMENT

| CS606101 - **Design And Analysis of Algorithms (NPTEL)** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To gain an idea about how to analyze algorithms
- To understand Divide and Conquer & Decrease and Conquer techniques and solve some problems using these techniques
- To understand Dynamic Programming technique and solve some problems using this technique
- To understand Branch and Bound technique and solve some problems using this technique
- To learn some basic approximation algorithms for NP-Hard Problems

**Week 1** Module 1: Introduction | Module 2: Examples and motivation | Module 3: Examples and motivation | Module 4: Asymptotic complexity: informal concepts | Module 5: Asymptotic complexity: formal notation | Module 6: Asymptotic complexity: examples | Assignments MCQ/Fill in blanks (unique answer)

**Week 2** Module 1: Searching in list: binary search | Module 2: Sorting: insertion sort | Module 3: Sorting: selection sort | Module 4: Sorting: merge sort | Module 5: Sorting: quicksort | Module 6: Sorting: stability and other issues | Assignments MCQ/Fill in blanks, programming assignment

**Week 3** Module 1: Graphs: Motivation | Module 2: Graph exploration: BFS | Module 3: Graph exploration: DFS | Module 4: DFS numbering and applications | Module 5: Directed acyclic graphs | Module 6: Directed acyclic graphs | Assignments MCQ/Fill in blanks, programming assignment

**Week 4** Module 1: Shortest paths: unweighted and weighted | Module 2: Single source shortest paths: Dijkstra | Module 3: Single source shortest paths: Dijkstra | Module 4: Minimum cost spanning trees: Prim's algorithm | Module 5: Minimum cost spanning trees: Kruskal's Algorithm | Module 6: Union-Find data structure | Assignments MCQ/Fill in blanks, programming assignment

**Week 5** Module 1: Divide and conquer: counting inversions | Module 2: Divide and conquer: nearest pair of points | Module 3: Priority queues, heaps | Module 4: Priority queues, heaps | Module 5: Dijstra/Prims revisited using heaps | Module 6: Search Trees: Introduction | Assignments MCQ/Fill in blanks, programming assignment

**Week 6** Module 1: Search Trees: Traversals, insertions, deletions | Module 2: Search Trees: Balancing | Module 3: Greedy : Interval scheduling | Module 4: Greedy : Proof strategies | Module 5: Greedy : Huffman coding | Module 6: Dynamic Programming: weighted interval scheduling | Assignments MCQ/Fill in blanks, programming assignment

**Week 7** Module 1: Dynamic Programming: memoization | Module 2: Dynamic Programming: edit distance | Module 3: Dynamic Programming: longest ascending subsequence | Module 4: Dynamic Programming: matrix multiplication | Module 5: Dynamic Programming: shortest paths: Bellman-Ford | Module 6: Dynamic Programming: shortest paths: Floyd Warshall | Assignments MCQ/Fill in blanks, programming assignment

**Week 8** Module 1: Intractability: NP-completeness | Module 2: Intractability: reductions | Module 3: Intractability: examples | Module 4: Intractability: more examples | Module 5: Misc topics | Module 6: Misc topics | Assignments MCQ/Fill in blanks

**TOTAL: 45 PERIODS**

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

CO1: Interpret the fundamental needs of algorithms in problem solving

CO2: Classify the different algorithm design techniques for problem solving

CO3: Develop algorithms for various computing problems

CO4: Analyze the time and space complexity of various algorithms

CO5: Identify the limitations of algorithms in problem solving

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | 2 | | | | | | 2 | | 2 | 3 | |
| CO2 | 3 | 3 | | 3 | | | | | | 2 | | 2 | 3 | |
| CO3 | 3 | 3 | 2 | | | | | | | 2 | | 2 | 3 | |
| CO4 | 3 | 3 | 3 | 3 | | | | | | 2 | | 2 | 3 | |
| CO5 | 3 | 3 | 3 | 3 | | | | | | 2 | | 2 | 3 | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.AnanyLevitin,"Introduction to the Design And Analysis of Algorithms", Third Edition, Pearson Education

2. Design and Analysis of Algorithms by ParagHimanshu Dave (Author), HimanshuBhalchandra Dave (Author)

3. Design and analysis of algorithms By S. Sridhar (Author)

**REFERENCE BOOKS:**

1.AlfredV.Aho, JohnE. Hopcroft, Jeffrey D.Ullman "The Design and Analysis of Computer Algorithms", 1st Edition

2.SachinDevGoyal, "Design and Analysis of Algorithm", First edition, University Science Press, 2009

3.Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.

**WEB RESOURCES:**

1.https://onlinecourses.nptel.ac.in/noc20_cs10/preview#:~:text=This%20course%20provides%20an%20introduction,used%20to%20solve%20these%20problems.

2.https://www.geeksforgeeks.org/design-and-analysis-of-algorithms/

## CS606102 - APP DEVELOPMENT

| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To introduce Application Development & Designing.
- To work with Android Storing and Retrieving Data
- To know about Android Networking and Web
- To develop a Graphics & Mobility and Location Based Services
- To understand Security and Hacking

**UNIT 1: INTRODUCTION** **9**

Introduction to Mobile Computing - Android Development Environment - Mobile Software Engineering. Frameworks and Tools - Generic UI Development - Android User - VUIs and Mobile Apps - Designing the Right UI - Multichannel and Multimodal UIs

**UNIT 2: INTENTS AND SERVICES** **9**

Android Intents and Services - Characteristics of Mobile Applications - Successful Mobile Development - Storing and Retrieving Data: Synchronization and Replication of Mobile Data - Getting the Model Right - Android Storing and Retrieving Data - Working with a Content Provider

**UNIT 3: WEB COMMUNICATION AND TELEPHONY** **9**

Communications Via Network and the Web : State Machine - Correct Communications Model - Android Networking and Web – Telephony : Deciding Scope of an App - Wireless Connectivity and Mobile Apps - Android Telephony - . Notifications and Alarms : Performance - Performance and Memory Management - Android Notifications and Alarms.

**UNIT 4: GRAPHICS AND MULTIMEDIA** **9**

Graphics : Performance and Multithreading - Graphics and UI Performance - Android Graphics - . Multimedia : Mobile Agents and Peer-to-Peer Architecture - Android Multimedia – Location : Mobility and Location Based Services – Android.

**UNIT 5: SECURITY AND HACKING** **9**

Security and Hacking : Active Transactions - More on Security - Hacking Android - Platforms and Additional Issues : Development Process – Architecture – Design - Technology Selection - Mobile App Development Hurdles – Testing.

**TOTAL: 45 PERIODS**

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

CO1 : Create simple Application Development & Designing.

CO2 : Create programs using Android Storing and Retrieving Data

CO3 : Explore the usage of Android Networking and Web

CO4 : Implement a Graphics & Mobility and Location Based Services

CO5 : Implement Security and Hacking

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | | 1 | | 2 | 1 | | | 2 | | | 3 | |
| CO2 | 2 | 1 | | | 3 | 1 | 1 | | | 2 | | | 3 | |
| CO3 | 2 | | 3 | 1 | 2 | 1 | | 1 | | 2 | | | 3 | |
| CO4 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | | | 2 | | | 3 | |
| CO5 | 1 | 2 | 1 | 2 | 2 | 1 | | 1 | | 2 | | | 3 | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

| **TEXT BOOKS:** |
|---|
| 1.Rick Rogers , John Lambardo “Android Application Development” 2018. |
| 2.Android Application Development (With Kitkat Support) by Pradeep Kothari (Author), Kogent Learning Solutions Inc. (Author) 2014 |
| 3.Learning Android: Develop Mobile Apps Using Java and Eclipse, 2nd Edition,MarkoGargenta and Masumi Nakamura |
| **REFERENCE BOOKS:** |
| 1.RavinderGoud&Gopichand “Mobile Application Development” |
| 2.BenFeigin “Mobile Application Development” |
| **WEB RESOURCES:** |
| 1.https://developer.android.com/?gclid=CjwKCAjw586hBhBrEiwAQYEnHQLEPhnP3_mYwjOUygwEhO4WH90BSCnOPMun_aK6SZxfeCgIidT1LhoCG-QQAvD_BwE&gclsrc=aw.ds |
| 2. https://flutter.dev |

| CS606103 - **PHP Programming** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **COURSE OBJECTIVES:** | | | | | |

- To introduce web development with PHP
- To work with various operations in PHP
- To model the design in a web environment
- To develop a webpage with database
- To test and work with a PHP application

| | |
|---|---|
| **UNIT 1: INTRODUCTION TO PHP** | **9** |
| PHP – History and Evolution – Installation – Language Basics – Lexical Structure – Datatypes – Variables – Expression & Operators – Flow Control statements – embedding PHP in web pages | |
| **UNIT 2: FUNCTIONS & STRINGS** | **9** |
| Calling a function – Defining a function – Variable scope – function parameters – return values – variable functions – Strings – Quoting string constants – Printing string – cleaning strings – encoding and escaping – comparing strings – manipulating and searching strings | |
| **UNIT 3: ARRAYS & OBJECTS** | **9** |
| Indexed versus Associative Arrays – Identifying elements of an array – Storing data in arrays – Multidimensional arrays –Extracting multiple values – Conversion between arrays and variables – Traversing arrays – Sorting – Working with arrays – Objects – Creation – Accessing Properties and methods – Declaration of class – Introspection | |
| **UNIT 4: WEB TECHNIQUES, GRAPHICS & SECURITY** | **9** |
| HTTP basics – Server Information – Processing Forms –Setting Response Headers – Maintaining State – SSL – Graphics – Embed an image – Create and draw images – Images with text – Dynamic buttons – Color handling – Security – Cross site scripting – File uploads and Access | |
| **UNIT 5: DATABASE ACCESS & APPLICATION** | **9** |
| PHP to access a database – Relational databases and SQL – MySQL object interface – Connectivity – Direct file level manipulation – Application techniques – code libraries – handing output - error reporting and suppression – performance tuning | |
| **TOTAL: 45 PERIODS** | |
| **COURSE OUTCOMES:** At the end of the course, the student will be able to | |
| CO1: Create simple basic PHP programs | |
| CO2: Create programs using functions and strings | |
| CO3: Explore the usage of arrays and objects | |
| CO4: Implement graphics, security and web techniques in designing | |
| CO5: Implement database connectivity with PHP | |
| **CO-PO MAPPING** | |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | | 1 | | 1 | 1 | | | | | | 2 | |
| **CO2** | 2 | 2 | | 1 | | 2 | 1 | 1 | | | | | 2 | |
| **CO3** | 3 | 1 | 2 | 2 | 1 | 1 | | 1 | | | | | 2 | 2 |
| **CO4** | 1 | | 3 | 2 | 2 | 1 | | 1 | | | | | 1 | 2 |
| **CO5** | 2 | 1 | | 2 | 2 | 1 | 1 | | | | | | 1 | 2 |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Kevin Tatroe, Peter MacIntyre&RasmusLerdorf, "Programming PHP", Creating Dynamic Web Pages, O'Reilly Media, 3rd Edition, 2013

2.Programming PHP: Creating Dynamic Web Pages, 4th Edition,KevinTatroe,peterMaclntyre.

3.PHP : The Complete Reference for Beginners,Anshul Saini,2023

**REFERENCE BOOKS:**

1.Steven Holzner ,"PHP: The Complete Reference", McGraw Hill Education,2008

2.Timothy Boronczyk , Martin E. Psinas,"PHP and MYSQL: Create - Modify – Reuse", Wiley India Private Limited ,2008

3.Matt Doyle, "Beginning PHP 5.3", Wiley Publishing Inc., 2009

**WEB RESOURCES:**

1.https://www.cloudkampus.com/

2.https://www.codecademy.com/

| CS606104 - **UI and UX Design** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **COURSE OBJECTIVES:** | | | | | |

- To provide students with the knowledge of user- centered design
- To understand user -centered methods in design, simulation and prototyping techniques
- To organize information about users into useful summaries with affinity diagrams.
- To convey user research and user experience design
- To understand wire framing and Prototyping software in the various UI/UX Design tools.

| | |
|---|---|
| **UNIT 1: INTRODUCTION TO THE UI** | **9** |
| User Interface Design (UI) -The Relationship Between UI and UX , Roles in UI/UX, A Brief Historical Overview of Interface Design, Interface Conventions, Approaches to Screen Based UI, Template vs Content. | |
| **UNIT 2: UI INTERFACE DESIGN** | **9** |
| Formal Elements of Interface Design, Active Elements of Interface Design, Composing the Elements of Interface Design, UI Design Process, Visual Communication design component in Interface Design. | |
| **UNIT 3: INTRODUCTION TO UX** | **9** |
| UX Basics- Foundation of UX design, Good and poor design, Understanding Your Users, Designing the Experience Elements of user Experience. I vs UX – Roles in UX.Careers option in UX - Design Careers - Research Careers - Strategy Careers - Career in UX | |
| **UNIT 4: DESIGN AND TESTING** | **9** |
| Visual Design Principles, Functional Layout, Interaction design, Introduction to the Interface, Navigation Design, User Testing, Developing and Releasing Your Design - UX Techniques - Gather and Analyse User Ideation techniques - Scenarios and storyboarding - Paper Prototype design and testing - development cycle. | |
| **UNIT 5: UI/ UX DESIGN TOOL** | **9** |
| User Study- Interviews, writing personas: user and device personas, User Context, Building Low Fidelity Wireframe and High-Fidelity Polished Wireframe Using wire framing Tools, Creating the working Prototype using Prototyping tools, Sharing and Exporting Design | |
| **TOTAL: 45 PERIODS** | |
| **COURSE OUTCOMES:** At the end of the course, the student will be able to | |
| CO1: Understand iterative user-centered design of graphical user interfaces | |
| CO2: Apply the user Interfaces to different devices and requirements | |
| CO3:Create high quality professional documents and artifacts related to the design process. | |
| CO4: Understand Design and Research Careers. | |
| CO5: Create UI/UX Design Tools. | |
| **CO-PO MAPPING** | |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | | | | | | | | | 1 | | 1 | 1 | 1 |
| **CO2** | 1 | | | | | | | | | 1 | | 1 | 1 | 1 |
| **CO3** | 1 | 1 | 1 | | | | | | | 1 | | 1 | 1 | 1 |
| **CO4** | 1 | 1 | 1 | | | | | | | 1 | | 1 | 1 | 1 |
| **CO5** | 1 | 1 | 1 | | | | | | | 1 | | 1 | 1 | 1 |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.A Project Guide to UX Design: For user experience designers in the field or in the making (2nd. ed.). Russ Unger and Carolyn Chandler. New Riders Publishing, USA, 2012

2.The Elements of User Experience: User-Centered Design for the Web and Beyond, Second Edition Jesse James Garrett, Pearson Education. 2011.

**REFERENCE BOOKS:**

1.The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques, Third Edition Wilbert O. Galitz , Wiley Publishing, 2007.

2.The UX Book Process and Guidelines for Ensuring a Quality User Experience, Rex Hartson and Pardha S. Pyla, Elsevier, 2012

**WEB RESOURCES:**

1.https://www.cloudkampus.com/

2.https://www.codecademy.com/

| CS606105 - **Software Testing (NPTEL)** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To learn the criteria for test cases.
- To learn the design of test cases.
- To understand test management and test automation techniques.
- To apply test metrics and measurements.

Week 1 : Introduction – Level of Testing – Basic Concepts of Testing – Unit Testing.

Week 2 : Equivalence and BV Testing – Special Value Testing Combinational Testing – Pairwise Testing – White Box Testing

Week 3 : MC/DC Testing – Path testing – Dataflow and Mutation Testing

Week 4 : Integration Testing – System Testing – Regression Testing

Week 5: Testing Object Oriented Programing

**TOTAL: 45 PERIODS**

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

CO1:Design test cases suitable for a software development for different domains.

CO2:Identify suitable tests to be carried out.

CO3:Prepare test planning based on the document.

CO4:Document test plans and test cases designed.

CO5:Use automatic testing tools.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | 3 | | | | | | | 2 | | | 3 | |
| **CO2** | 2 | 3 | 3 | | | | | | | 2 | | | 2 | |
| **CO3** | 2 | | 2 | | | | | | | 2 | | | 2 | 2 |
| **CO4** | | 2 | 3 | | | | | | | 2 | | | 2 | 2 |
| **CO5** | | 2 | 2 | | | | | | | 2 | | | 2 | 2 |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1. Srinivasan Desikan and Gopalaswamy Ramesh, ―Software Testing – Principles and Practices‖, Pearson Education, 2006.

2. Ron Patton, ―Software Testing‖, Second Edition, Sams Publishing, Pearson Education, 2007. AU Library.com

**REFERENCE BOOKS:**

1. Ilene Burnstein, ―Practical Software Testing, Springer International Edition, 2003.

2. Edward Kit,Software Testing in the Real World – Improving the Process, Pearson Education, 1995.

3. Boris Beizer, Software Testing Techniques – 2nd Edition, Van Nostrand Reinhold, New York, 1990.

**WEB RESOURCES:**

1.https://www.besanttechnologies.com/

2.https://www.rejinpaul.com/

| CS606106 - **Web Application Security** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **COURSE OBJECTIVES:** | | | | | |

- To reveal the underlying in web application.
- To identify and aid in fixing any security vulnerabilities during the web development process.
- To understand the security principles in developing a reliable web application.
- To Understand penetration testing to improve the security of web applications
- To Use industry standard tools for web application security.

| **UNIT 1: OVERVIEW OF WEB APPLICATIONS & SECURITY** | **9** |
|---|---|
| Introduction history of web applications interface ad structure benefits and drawbacks of web applications Web application Vs Cloud application - Security Fundamentals: Input Validation - Attack Surface Reduction Rules of Thumb- Classi- fying and Prioritizing Threads | |
| **UNIT 2:SECURITY PRINCIPLES** | **9** |
| Origin Policy - Exceptions to the Same-Origin Policy - Cross-Site Scripting and Cross-Site Request Forgery - Reflected XSS - HTML Injection - Clickjacking - DNS rebinding - Flash security - Java applet security - Single-sign-on solution and security - IPv6 impact on web security. | |
| **UNIT 3: WEB APPLICATION VULNERABILITIES** | **9** |
| Understanding vulnerabilities in traditional client server application and web applications, client state manipulation, cookie based attacks, SQL injection, cross domain attack (XSS/XSRF/XSSI) http header injection. SSL vulnerabilities and testing - Proper encryption use in web application - Session vulnerabilities and testing - Cross-site request forgery | |
| **UNIT 4: WEB APPLICATION MITIGATIONS** | **9** |
| Http request , http response, rendering and events , html image tags, image tag security, issue, java script on error , Java script timing , port scanning , remote scripting , running remote code, frame and iframe , browser sandbox, policy goals, same origin policy, library import, domain relaxation | |
| **UNIT 5: SECURE WEBSITE DESIGN** | **9** |
| Secure website design : Architecture and Design Issues for Web Applications, Deployment Considerations Input Validation, Authentication, Authorization, Configuration Management ,Sen- sitive Data, Session Management, Cryptography, Parameter Manipulation, Exception Manage- ment, Auditing and Logging, Design Guidelines, Forms and validity, Technical implementation | |
| **TOTAL: 45 PERIODS** | |
| **COURSE OUTCOMES:** At the end of the course, the student will be able to | |
| CO1:Understand the underlying in web application. | |
| CO2:Identify and aid in fixing any security vulnerabilities during the web development process. | |
| CO3:Understand the security principles in developing a reliable web application. | |

CO4:Understand penetration testing to improve the security of web applications

CO5:Create standard tools for web application security.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | | | | | | | | 2 | | 2 | 2 | |
| **CO2** | 2 | 2 | | | | | | | | 2 | | 2 | 2 | |
| **CO3** | 2 | 2 | | | | | | 1 | | 2 | | 2 | 2 | |
| **CO4** | 2 | 2 | | | | | | 1 | | 2 | | 2 | 2 | |
| **CO5** | 2 | 2 | | | | | | | | 2 | | 2 | 2 | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Sullivan, Bryan, and Vincent Liu. Web Application Security, A Beginner's Guide. McGraw Hill Professional, 2011.

2.Web Application Security,by Andrew Hoffman,2020

**REFERENCE BOOKS:**

1.Stuttard, Dafydd, and Marcus Pinto. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws. John Wiley Sons, 2011

2.Developing Web Applications,by M.T. Savaliya ,2013

**WEB RESOURCES:**

1.https://leveetech.com/

2.https://www.guvi.in/

CS606107 - **Dev-ops**

| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To provide students with the knowledge of DevOps
- To understand Cloud and virtualization architecture
- To know about Jenkins and its architecture
- To know about Docker and its technology
- To know about Kubernetes Cluster Architecture

**UNIT 1: INTRODUCTION** **9**

DevOps Principles in detail - DevOps Engineer Skills in the market - Knowing DevOps Delivery Pipeline - Market trend of DevOps - DevOps Technical Challenges - Tools we use in DevOps.

**UNIT 2: DEVOPS ON CLOUD** **9**

Essentials of Cloud computing - Cloud and virtualization architecture - Cloud deployment architecture - Cloud providers – An overview - Introducing to Amazon web services.

**UNIT 3: JENKINS** **9**

Essentials of Continuous Integration - Jenkins and its architecture - Jenkins tool Management - User management in Jenkins – Authentication: Jenkins own database user creation – Authorization: Matrix based authorization - Project based authorization

**UNIT 4: WEB APPLICATION MITIGATIONS** **9**

Introduction - Real-world Shipping Transportation Challenges - Docker and its technology - Docker images and containers - Working with container: Share and copy a container - Container Life Cycle - Base Image and customize - Creation of Docker File - Publish Image on Docker Hub

**UNIT 5:KUBERNETES** **9**

Introduction to Kubernetes - Kubernetes Cluster Architecture — An overview - Understanding concepts of Pods, Replica sets, deployments and namespaces - concepts of services and networking - Persistent volumes and persistent volume claims —an overview - Design of Pods - labels, selectors, jobs, and schedulers

**TOTAL: 45 PERIODS**

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

CO1:Understand with the knowledge of DevOps

CO2:Create Cloud and virtualization architecture

CO3:Understand Jenkins and its architecture & own database user creation

CO4:Creation of Docker File and its technology

CO5:Understand concepts of Pods, Replica sets, deployments and namespaces

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 2 | 1 | | 1 | | 2 | 2 | 1 | | 1 | | 3 | |
| **CO2** | 2 | 3 | 2 | 3 | 1 | | 1 | 1 | | | 2 | | 2 | |
| **CO3** | 1 | 2 | 3 | 3 | 2 | | 2 | 1 | 2 | | 2 | | 3 | |
| **CO4** | 2 | 1 | 2 | 2 | 2 | | 2 | 1 | | | 1 | | 3 | |
| **CO5** | 1 | | 2 | 2 | 2 | | 3 | 1 | 2 | | 2 | | 3 | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

| **TEXT BOOKS:** |
| --- |
| 1.Joseph Joyner , MihalisKonoplovs “DevOps for Begineers” 2015 |
| 2.MikaelKrief “Learning DevOps – Complete Guide” Packt Publications , 2019 |
| **REFERENCE BOOKS:** |
| 1.IshaqAzhar Mohammed , DhayaSindhuBattina , Dr.Mehul Patel “Introduction to DevOps” 2021 |
| 2.Effective DevOps,By Jennifer Davis, Ryn Daniels · 2016 |
| **WEB RESOURCES:** |
| 1.https://www.simplilearn.com/ |
| 2.https://intellipaat.com/ |

| CS606108 - **Principles of Programming Languages** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To know the knowledge of Programming
- To understand Basic Knowledge of Names, Bindings, and Scopes
- To know about Subprograms and Blocks
- To know about Concurrency in Function Languages
- To know about Functional Programming & Scripting Languages

| **UNIT 1: PRELIMINARY CONCEPTS** | **9** |
|---|---|

Concepts of Programming Languages, Programming Domains, Language Evaluation Criteria, Influences on Language Design, Language Categories, Language Design Trade-Offs, Implementation Methods, Programming Environments - General Problem of Describing Syntax and Semantics, Formal Methods of Describing Syntax, Attribute Grammars, Describing the Meanings of Programs.

| **UNIT 2: NAMES, BINDINGS, AND SCOPES** | **9** |
|---|---|

Introduction, Names, Variables, Concept of Binding, Scope, Scope and Lifetime, Referencing Environments, Named Constants - introduction, Primitive Data Types, Character String Types, User Defined Ordinal Types, Array, Associative Arrays, Record, Union, Tuple Types, List Types, Pointer and Reference Types, Type Checking, Strong Typing, Type Equivalence.

| **UNIT 3: SUBPROGRAMS AND BLOCKS** | **9** |
|---|---|

Fundamentals of Sub-Programs, Design Issues for Subprograms, Local Referencing Environments, Parameter Passing Methods, Parameters that Are Subprograms, Calling Subprograms Indirectly, Overloaded Subprograms, Generic Subprograms, Design Issues for Functions, User Defined Overloaded Operators, Closures, Co routines

| **UNIT 4: CONCURRENCY** | **9** |
|---|---|

Introduction, Introduction to Subprogram Level Concurrency, Semaphores, Monitors, Message Passing, Java Threads, Concurrency in Function Languages, Statement Level Concurrency. Exception Handling and Event Handling: Introduction, Exception Handling in Ada, C++, Java, Introduction to Event Handling, Event Handling with Java and C#.

| **UNIT 5: FUNCTIONAL PROGRAMMING LANGUAGES** | **9** |
|---|---|

Introduction, Mathematical Functions, Fundamentals of Functional Programming Language, LISP, Support for Functional Programming in Primarily Imperative Languages, Comparison of Functional and Imperative Languages - Scripting Language: Pragmatics, Key Concepts, Case Study: Python – Values and Types, Variables, Storage and Control, Bindings and Scope, Procedural Abstraction, Data Abstraction, Separate Compilation, Module Library.

**TOTAL: 45 PERIODS**

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

CO1:Acquire the skills for expressing syntax and semantics in formal notation

CO2:Identify and apply a suitable programming paradigm for a given computing application

CO3:Gain knowledge of and able to compare the features of various programming languages

CO4:Understand Statement Level Concurrency

CO5:Create Functional Programming in Primarily Imperative Languages

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | | | | | | | 2 | | | 3 | |
| **CO2** | 2 | 3 | 3 | | | | | | | 2 | | | 2 | |
| **CO3** | 2 | | 2 | 3 | 3 | | | | | 2 | | | 2 | 2 |
| **CO4** | | 2 | 3 | | 2 | | | | | 2 | | | 2 | 2 |
| **CO5** | | 2 | 2 | | 3 | | | | | 2 | | | 2 | 2 |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Concepts of Programming Languages Robert. W. Sebesta 10/E, Pearson Education.

2.Programming Language Design Concepts, D. A. Watt, Wiley Dreamtech, 2007

**REFERENCE BOOKS:**

1.Programming Languages, 2nd Edition, A.B. Tucker, R. E. Noonan, TMH.

2.Programming Languages, K. C. Louden, 2nd Edition, Thomson, 2003

**WEB RESOURCES:**

1.https://www.simplilearn.com/

2.https://intellipaat.com/

CS606109 - **Social Networks (NPTEL)**

| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- Build and strengthen your brand
- Increase your traffic
- Connect with your audience
- Drive conversions
- Increase your presence

Week 1: Introduction

Week 2: Handling Real-world Network Datasets

Week 3: Strength of Weak Ties

Week 4: Strong and Weak Relationships (Continued) &Homophily

Week 5: Homophily Continued and +Ve / -Ve Relationships

Week 6: Link Analysis

Week 7: Cascading Behaviour in Networks

Week 8: Link Analysis (Continued)

Week 9: Power Laws and Rich-Get-Richer Phenomena

Week 10: Power law (contd..) and Epidemics

Week 11: Small World Phenomenon

Week 12: Pseudo core (How to go viral on web)

**TOTAL: 45 PERIODS**

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

CO1:Driving Traffic

CO2:Enhancing the Customer Experience

CO3:Learning and Education

CO4:Motivating Young People

CO5:Creativity

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | | | | | | | 2 | | | 2 | |
| CO2 | 2 | 2 | 2 | | | | | | | 2 | | | 2 | |
| CO3 | 2 | 2 | 2 | | | | | | | 2 | | | 2 | |
| CO4 | 2 | 2 | 2 | | | | | | | 2 | | | 2 | |
| CO5 | 2 | 2 | 2 | | | | | | | 2 | | | 2 | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Social Networking And Cyberspirituality Towards A Theology of Networks by Rev Jim M R Paul, Christian World Imprints

2.Social Networking by Kenneth Partridge

**REFERENCE BOOKS:**

1.All About Social Networking by Patti Richards,Apr 2018

2.Social Network Analysis for Start-ups, October 2015 by Maksim Tsvetovat (Author), Alexander Kouznetsov (Author)

| **WEB RESOURCES:** |
| --- |
| https://www.frontiersin.org/ |
| https://digitalcommons.unl.edu/libphilprac/3727/ |

| CS606110 - **MULTIMEDIA TECHNOLOGY** | | | | | | |
|---|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C | |
| | | 3 | 0 | 0 | 3 | |
| COURSE OBJECTIVES: | | | | | | |

- To examine the notions of multimedia, graphics and image data, video data, and audio data
- To learn about digital audio and its compression
- To learn the various multimedia data compression techniques
- To know the idea behind the image and video compression techniques
- To learn network protocols, multimedia content distribution and CBIR multimedia

| **UNIT 1: INTRODUCTION** | 9 |
|---|---|
| Multimedia – Definitions, components. Multimedia software tools – Multimedia presentation – Data compression –Multimedia production – Multimedia sharing and distribution. Graphics and Image data representations | |
| **UNIT-2 : DIGITAL AUDIO AND COMPRESSION** | 9 |
| Basics of digital audio – Digitization of sound – MIDI – Quantizationa and Transmission of Audio - Basic audiocompression techniques: ADPCM in speech coding – MPEG audio compression. | |
| **UNIT-3 : MULTIMEDIA DATA COMPRESSION** | 9 |
| Lossless compression algorithms: Run-length coding, variable-length coding, dictionary-based coding, arithmeticcoding. Lossless image compression. Lossy compression algorithms: Quantization, transform coding,wavelet-based coding, wavelet packets, embedded Zerotree of wavelet coefficients. | |
| **UNIT-4 : IMAGE COMPRESSION** | 9 |
| Color models in images - Image compression standards: JPEG standard, JPEG2000 standard: Main steps, Region-of-Interest coding – JPEG-LS standard - Bi-level image compression standards. | |
| **UNIT-5 : VIDEO COMPRESSION** | 9 |
| Color models in Video - Basic video compression techniques: Video compression based on motion compensation, search for motion vectors, H.261 and H.263 – New video coding standards | |
| **TOTAL: 45 PERIODS** | |

| **COURSE OUTCOMES:** At the end of the course, the student will be able to |
|---|
| CO1: Identify suitable data representations for use in appropriate multimedia applications |
| CO2: Work with the various audio compression techniques |
| CO3: Select suitable data compression technique for respective application |
| CO4: Interpret the image and video compression standards and techniques |
| CO5: Examine the protocols for multimedia transmission and content distribution |
| **CO-PO MAPPING** |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | - | 2 | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO2 | 2 | 2 | 2 | 2 | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO3 | 2 | 2 | - | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO4 | 2 | 2 | 2 | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO5 | 2 | 2 | - | 2 | 2 | - | - | - | - | 2 | - | 2 | - | - |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Ze-Nian Li, Mark S. Drew, and Jiangchuan Liu, "Fundamentals of Multimedia", Second Edition, Springer, 2014.

2.Tay Vaughan, "Multimedia: Making It Work", McGraw-Hill Education, ninth edition, 2014.

**REFERENCE BOOKS:**

1.Ralf Steinmetz and KlaraNahrstedt, "Multimedia: Computing, Communications and Applications",Pearson
Education, 2012.

2.Banerji Ashok &GhoshAnanda Mohan, "Multimedia Technologies", Tata McGraw Hill, New Delhi 2010.

**WEB RESOURCES:**

1.https://core.ac.uk/download/pdf/82176089.pdf

2.https://developer.mozilla.org/en-US/docs/Web/Media

# VERTICAL II
# CLOUD AND DATA SCIENCE

<table>
<tr><td colspan="6">CS606201 - CLOUD COMPUTING (NPTEL)</td></tr>
<tr><td>Course Category: Programme Elective</td><td>Course Type: Theory</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td colspan="2"></td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>COURSE OBJECTIVES:</td><td colspan="5"></td></tr>
<tr><td colspan="6">• To know about Cloud Architecture and Virtualization<br>• To learn Management Level and Google Cloud Platform<br>• To know about Cloudonomics and Security Level Implementation<br>• To apply Fog Computing and Sensor Cloud Computing<br>• To analyse various VM Migration Techniques used in Cloud Computing.</td></tr>
<tr><td colspan="5">UNIT 1:INTRODUCTION</td><td>9</td></tr>
<tr><td colspan="6">Overview –Introduction – Architecture – Deployment Models – Virtualization – XML Basics I - XML Basics – II – Web Services – Service Oriented Architecture</td></tr>
<tr><td colspan="5">UNIT-2 : SERVICE LEVEL MANAGEMENT</td><td>9</td></tr>
<tr><td colspan="6">Service Level Management – Cloud Computing – Managing Data – Introduction to Mapreduce – Open Stack – Open Stack Demo – Cloud Microsoft Azure – Google Cloud Platform</td></tr>
<tr><td colspan="5">UNIT-3 : CLOUD COMPUTING SECURITY</td><td>9</td></tr>
<tr><td colspan="6">SLA – Cloudonomics – Mapreduce – Resource Management – I , Resource Management –II , Cloud Computing Security – I , II , III – Security Issues in Colloborative SaaS Cloud – Broker for Cloud Marketplace</td></tr>
<tr><td colspan="5">UNIT-4 : FOG COMPUTING</td><td>9</td></tr>
</table>

Mobile Computing I ,II – Fog Computing I , II – Use case: Geo Spatial Cloud – Introduction to Docker Container – Green Cloud – Sensor Cloud Computing – IoT Cloud – Course Summary and Research Areas.

**UNIT-5 : VM MIGRATION** 9

Cloud Federation – VM Migration – basic Migration Strategies – Containers Container based virtualization Kubernetes Docker Container - Demo

TOTAL: 45 PERIODS

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

CO1: Describe about Cloud Architecture and Virtualization

CO2: Apply Management Level and Google Cloud Platform

CO3: Demonstrate about Cloudonomics and Security Level Implementation

CO4: Analyse Fog Computing and Sensor Cloud Computing Techniques

CO5: Evaluate various VM Migration Techniques used in Cloud Computing.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | | | | | | 3 | 2 | | 3 | | 2 |
| CO2 | 3 | 2 | 2 | | | | | | | 3 | | | 2 | 3 |
| CO3 | 2 | 3 | 3 | | | | | | 2 | 2 | | 2 | | |
| CO4 | 3 | 2 | 3 | | | | | | | 2 | | | 2 | 2 |
| CO5 | 3 | 3 | 2 | | | | | | 2 | 3 | | 3 | | |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Prof.Soumya Kanti Ghosh ,"Cloud Computing" Department of Computer Science and Engineering,IIT Guwahati,2017.

2.Lizhe Wang, Rajiv Ranjan, Jinjun Chen, Boualem Benatallah," Cloud Computing", CRC Press,2017.

3.Thomas Erl , Zalgharm Mahmood , Richard Puttini,"Cloud Computing – Concepts,Technology and Architecture"PearsonPublication,First Edition,201

**REFERENCE BOOKS:**

1) A.Srinivasan , J.Suresh , "Cloud Computing – A Practical approach for Learning and Implementation" Pearson Publication , First Edition ,2014.

2) Kailash Jayaswal,JagannathKallakurchi,DonaldJ.Houde,Dr.DevenShah,"Cloud Computing – Black Book"Dreamtech Press,2014.

3)Anthony T.Velte , Toby J.Velte , Robert Elsenpeter , "Cloud Computing-A Practical Approach",Tata McGraw Hill Education,2017.(Indian Edition)

**WEB RESOURCES:**

1.https://www.knowledgehut.com/blog/cloud-computing/top-cloud-computing-resources

2.https://westportlibrary.libguides.com/CloudComputing

| CS606202 - **VIRTUALIZATION** | | | | | |
|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES: | | | | | |

- To understand the concept of Virtualization
- To know the virtualization infrastructure
- To build the cloud deployment models
- To know the Hadoop Framework
- To know the Cloud Infrastructure security

| **UNIT 1: VIRTUALIZATION** | 9 |
|---|---|

Basics of Virtual Machines - Process Virtual Machines System Virtual Machines – Emulation– Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization– Management Virtualization — Hardware Maximization – Architectures – Virtualization Management– Storage Virtualization– Network Virtualization

| **UNIT 2: VIRTUALIZATION INFRASTRUCTURE** | 9 |
|---|---|

Comprehensive Analysis– Resource Pool – Testing Environment – Server Virtualization– Virtual Workloads – Provision Virtual Machines– Desktop Virtualization – Application Virtualization - Implementation levels of virtualization– virtualization structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management– Virtualization for data center automation.

| **UNIT 3: CLOUD PLATFORM ARCHITECTURE** | 9 |
|---|---|

Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything asa service: Infrastructure, platform, software- A Generic Cloud Architecture Design– Layered cloud Architectural Development– Virtualization Support and Disaster Recovery– Architectural Design Challenges - Public Cloud Platforms : GAE,AWS– Inter-cloud Resource Management

| **UNIT 4: PROGRAMMING MODEL** | 9 |
|---|---|

Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job – Developing Map Reduce Applications -Design of Hadoop file system – Setting up Hadoop Cluster - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Nimbus

| **UNIT 5: CLOUD SECURITY** | 9 |
|---|---|

Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud - Key privacy issues in the cloud – Cloud Security and Trust Management

TOTAL: 45 PERIODS

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

CO1: Deploy the concepts of virtualization strategies and virtual machines

CO2: Apply the concept of virtualization infrastructure in the cloud computing

CO3: Identify the architecture and deployment models of cloud computing

CO4: Develop cloud services using cloud computing for real time environment

CO5: Apply the security models in the cloud environment

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 2 | | 1 | | | | | 3 | 2 | | 2 | 1 |
| CO2 | 2 | 3 | 3 | | | | | | 2 | 2 | | 1 | | 2 |
| CO3 | 2 | 1 | 3 | | | | | | | 3 | 1 | | 1 | |
| CO4 | 3 | 2 | 1 | | 2 | | | | 2 | 3 | | 2 | | 1 |
| CO5 | 3 | 2 | 1 | | 2 | | | | | 2 | 2 | 2 | 2 | 2 |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Danielle Ruest, Nelson Ruest, ―Virtualization: A Beginner‟s Guide‖, McGraw-Hill Osborne Media,2009.2.

2.Jim Smith, Ravi Nair , "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 20053.

3.John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.

**REFERENCE BOOKS:**

1.Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.5.

2.Tim Mather, Subra Kumaraswamy, and Shahed Latif ,"Cloud Security and Privacy", O'Reilly Media,Inc.,2009.6.

3.Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.7.

**WEB RESOURCES:**

1.www.ibm.com/in-en/topics/virtualization

2.https://www.sciencedirect.com/topics/computer-science/virtualized-resource.

| CS606203 - **CLOUD COMPUTING AND DISTRIBUTED SYSTEMS (NPTEL)** | | | | | |
|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To discuss the fundamental concepts of Cloud Computing
- To analyse different algorithms in Cloud Computing
- To simulate the different Cloud Data Centers.
- To get the knowledge of Key and HBase.
- To know about peer-to-peer and Spark Technique.

| **UNIT 1: OVERVIEW** | 9 |
|---|---|

Introduction to Cloud Computing - Virtualization - Hotspot Mitigation for Virtual Machine Migration - Server Virtualization - Software Defined Network - Geo-distributed Cloud Data Centers.

| **UNIT 2: DISTRIBUTED ALGORITHM** | 9 |
|---|---|

Leader Election in Rings (Classical Distributed Algorithms) - Leader Election (Ring LE & Bully LE Algorithm) - Design of Zookeeper

| **UNIT 3: CLOUD DATA CENTERS** | 9 |
|---|---|

Time and Clock Synchronization in Cloud Data Centers - Global State and Snapshot Recording Algorithms - Distributed Mutual Exclusion - Consensus in Cloud Computing and Paxos

| **UNIT 4: KEY AND HBASE** | 9 |
|---|---|

Design of Key-Value Stores - Design of HBase - Introduction to Kafka

| **UNIT 5: SPARK** | 9 |
|---|---|

Peer to Peer Systems in Cloud Computing - MapReduce - Introduction to Spark

TOTAL: 45 PERIODS

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

CO1: Build the fundamental concepts of Cloud Computing

CO2: Apply different algorithms in Cloud Computing

CO3:Develop the different Cloud Data Centers.

CO4: Learn the knowledge of Key and HBase

CO5: Apply about peer-to-peer and Spark Technique.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 3 | | | | | | 2 | 3 | | 2 | | 3 |
| CO2 | 3 | 2 | 2 | | | | | | 3 | 2 | | | 3 | |
| CO3 | 2 | 3 | 2 | | | | | | | 3 | | 3 | | 2 |
| CO4 | 3 | 2 | 3 | | | | | | | 2 | | 2 | 3 | |
| CO5 | 2 | 3 | 2 | | | | | | 2 | 3 | | 3 | | 3 |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Prof.Rajiv Mishra , "Cloud Computing and Distributed Systems" Department of Computer Science and Engineering,IIT Patna,2021.

2.Kai Hwang , Geoffrey C.Fox , Jack J.Dongarra , "Distributed and Cloud Computing" Morgan Kaufmann Publisher,First Edition,2013.

| |
|---|
| 3.Rajiv Mishra,Yashwant Singh Patel,"Cloud and Distributed Computing – Algorithms and Systems",Wiley Publisher,2020. |
| **REFERENCE BOOKS:** |
| 1.Raj Kumar Bayya , James broberg , Andrzej Goscinski ,"Cloud Computing – Principles and Paradigms", Wiley Publisher, First Edition,2018. |
| 2.Kenneth P.Birman , "Guide to Reliable Distributed Systems", Springer Publisher,2012. |
| 3.Christian Vecchiola , S.Thamarai Selvi,Rajkumar Bayya , "Mastering Cloud Computing "MorganKaufmann, First Edition.,2013. |
| **WEB RESOURCES:** |
| 1.https://onlinecourses.nptel.ac.in/noc21_cs15/preview |
| 2.https://www.classcentral.com/course/swayam-cloud-computing-and-distributed-systems-17544 |

| CS606204 - **DATA WAREHOUSING** | | | | | |
|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To understand data warehouse concepts, architecture, business analysis and tools
- To understand data pre-processing and data visualization techniques
- To study algorithms for finding hidden and interesting patterns in data
- To understand and apply various classification and clustering techniques using tools.
- To Know about the Weka Tool

| **UNIT 1: DATA WAREHOUSING-INTRODUCTION** | 9 |
|---|---|

Basic Concepts - Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors - Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies - Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

| **UNIT 2: DATA MINING – INTRODUCTION** | 9 |
|---|---|

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

| **UNIT 3: DATA MINING - FREQUENT PATTERN ANALYSIS** | 9 |
|---|---|

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns

| **UNIT 4: CLASSIFICATION AND CLUSTERING** | 9 |
|---|---|

Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy. Clustering Techniques – Cluster analysis-Partitioning Methods - Hierarchical Methods – Density Based Methods - Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.

| **UNIT 5: WEKA TOOL** | 9 |
|---|---|

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

**TOTAL: 45 PERIODS**

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

CO1: Design a Data warehouse system and perform business analysis with OLAP tools.

CO2: Apply suitable pre-processing and visualization techniques for data analysis

CO3 : Apply the algorithms for finding hidden and interesting patterns in data.

CO4: Apply various classification and clustering techniques using tools.

CO5: Know about the Weka Tool

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 2 | | 2 | | | | 2 | 2 | 2 | | | |
| CO2 | 3 | 2 | 1 | | | | | | | 3 | | 2 | 1 | 2 |
| CO3 | 2 | 3 | 3 | | 1 | | | | 1 | 2 | 1 | 1 | 2 | 1 |
| CO4 | 3 | 2 | 3 | | | | | | | 3 | | | | 1 |
| CO5 | 2 | 3 | 2 | | 1 | | | | 1 | 3 | 2 | 2 | 2 | |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Jiawei Han, Micheline Kamber, JianPai, "DataMining: Concepts and Techniques", Morgan Kaufman Publishers, Third Edition, 2012.
2.Nenad Jukic, SusanVrbsky, SvetlozarNestorov," DatabaseSystems: Introduction to Database and Data Warehouses", Prospect Press,1st Edition,2020.
3.Pang-Nong Tan, MichaelSteinbach,Anuj Karpatne,Vipin Kumar ,"Introduction to Data Mining"Pearson,Second Edition,2021.

**REFERENCE BOOKS:**

1.Bharat Bhushan Agarwal, Sumit Prakash Tayal, "Data Mining and Data Warehousing", University Science, First Edition, 2009.

2.Mehmed Kantardzic, "DataMining Concepts, Models, Methods and Algorithms", Wiley Publications, Second Edition,2011.

3.Khushboo Saxena , Sandeep Saxena , AkashSaxena ,"Data Mining and Data Warehousing"BPB Publications,2014.

**WEB RESOURCES:**

1.www.topcoder.com/thrive/articles/data-warehousing-data-mining.

2.https://www.simplelearn.com/data-warehouse-article.

| CS606205 - **STORAGE TECHNOLOGIES** | | | | | | |
|---|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To understand the underlying principles of spoilage and storage
- To provide knowledge on different storage methods and packaging techniques
- To Learn Functions of Packaging Materials
- To apply package material testing
- To implement Special Packaging Techniques

**UNIT 1: SPOILAGE AND STORAGE** 9

Direct damages, Indirect damages of perishable and durable commodities – control measures - factors affecting storage – types of storage – Losses in storage and estimation of losses.

**UNIT 2: STORAGE METHODS** 9

Improved storage methods for grain-modern storage structures-infestation-temperature and moisture changes in storage structures-CAP storage-CA storage of grains and perishables construction operation and maintenance of CA storage facilities

**UNIT 3: FUNCTIONS OF PACKAGING MATERIALS** 9

Introduction – packaging strategies for various environment – functions of package – packaging materials – cushioning materials – bio degradable packaging materials – shrink and stretch packaging materials.

**UNIT 4: FOOD PACKAGING MATERIALS AND TESTING** 9

Introduction – paper and paper boards - flexible - plastics - glass containers – cans – aluminium foils - package material testing-tensile, bursting and tear strength.

**UNIT 5:SPECIAL PACKAGING TECHNIQUES** 9

Vacuum and gas packaging - aseptic packaging - retort pouching – edible film packaging – tetra packaging – antimicrobial packaging – shrink and stretch packaging.

TOTAL: 45 PERIODS

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

CO1: Understand the underlying principles of spoilage and storage

CO2: Provide knowledge on different storage methods and packaging techniques

CO3: Learn Functions Of Packaging Materials

CO4: Apply package material testing

CO5: Implement Special Packaging Techniques

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | 2 | | | | 2 | 3 | | 1 | 2 | |
| CO2 | 3 | 2 | 3 | 2 | | | | | | 2 | 2 | 2 | | 1 |
| CO3 | 3 | 1 | 3 | | 1 | | | | 1 | 3 | | | 1 | |
| CO4 | 3 | 2 | 3 | | | | | | | 3 | 2 | | | 1 |
| CO5 | 1 | 2 | 3 | | 1 | | | | 3 | 2 | 2 | 2 | 2 | 2 |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Sahay, K.M. and K.K.Singh. 1996. Unit operations of agricultural processing. Vikas Publishing House Pvt. Ltd., New Delhi.

| |
|---|
| 2. Food Packaging Technology, Hand book, 2004. NIIR Board, New Delhi |
| 3.Pandey, P.H.2002. Post harvest engineering of horticultural crops through objectives. SarojPrakasam. Allahabad. |
| **REFERENCE BOOKS:** |
| 1.Himangshu Barman. 2008, Post Harvest Food grain storage. Agrobios (India), Jodhpur. |
| 2.Chakaraverty, A. 2000. 3rd edition. Post harvest technology of cereals, pulses and oil seeds. Oxford & IBH publishing &Co.Pvt.Ltd. New Delhi. |
| 3.P.Komarnicki,Pio Alessandro Lombadi,Z.A.Styczynski "Storage Technologies and Systems",April 2017. |
| **WEB RESOURCES:** |
| 1.https://www.researchgate.net/publication/318169073_Storage_Technologies_and_Systems. |
| 2.https://www.sciencediredt.com/topics/computer-science/storage-resource. |

| CS606206 - **SOFTWARE DEFINED NETWORKS** | | | | | |
|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To learn the fundamentals of software defined networks
- To understand the separation of the data plane and the control plane.
- To Know about data center concepts
- To study about the SDN Programming
- To study about the various applications of SDN

| **UNIT 1: INTRODUCTION** | 9 |
|---|---|

History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized and Distributed Control and Date Planes

| **UNIT 2: OPEN FLOW & SDN CONTROLLERS** | 9 |
|---|---|

Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor-Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts

| **UNIT 3: FUNCTIONS OF PACKAGING MATERIALS** | 9 |
|---|---|

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE

| **UNIT 4: SDN PROGRAMMING** | 9 |
|---|---|

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications

| **UNIT 5: SDN** | 9 |
|---|---|

Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration

TOTAL: 45 PERIODS

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

CO1: Know the undying principle of Software Defined Networks

CO2: Analyse the separation of data plane and control plane

CO3: Learn the data center concepts

CO4: Know SDN Programming in detail

CO5: Learn various SDN Applications

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 3 | 2 | | 1 | | | | 3 | 3 | 1 | 1 | 2 | 1 |
| CO2 | 2 | 1 | 3 | | 1 | | | | 2 | 2 | 2 | | | 2 |
| CO3 | 2 | 3 | 3 | | | | | | | 2 | | | | |
| CO4 | 2 | 3 | 2 | | | | | | 2 | 3 | 1 | 2 | 2 | |
| CO5 | 3 | 2 | 3 | | 2 | | | | 1 | 2 | 2 | 2 | | 1 |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Paul Goransson and Chuck Black, Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.

| |
|---|
| 2.Thomas D. Nadeau, Ken Gray, SDN: Software Defined Networks, O'Reilly Media, 2013. |
| 3.Dr.Arati A.Dandavate , I.A.Dhotre “Software Defined Networks” Technical Publications,Feb 2023. |
| **REFERENCE BOOKS:** |
| 1.Siamak Azodolmolky, ―Software Defined Networking with Open Flow, Packet Publishing, 2013 |
| 2. Vivek Tiwari, ―SDN and Open Flow for Beginners‖, Amazon Digital Services, Inc., 2013. |
| 3.Fei Hu, Editor, ―Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014. |
| **WEB RESOURCES:** |
| 1.https://www.vmware.com/topics/glossary/content/software-defined-networking.html |
| 2.https://www.opensource.com/resources/what-is-software-defined-networking |

| CS606207 - **GRID COMPUTING** | | | | | | |
|---|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C | |
| | | 3 | 0 | 0 | 3 | |

**COURSE OBJECTIVES:**

- To understand about the basic fundamentals of Grid computing.
- To gain knowledge about the standards of messaging in Grid Computing
- To understand about the key concepts of Grid service Architecture.
- To understand how to proceed basic services of Grid computing.
- To learn about the architecture and model of Globus Toolkit.

| | |
|---|---|
| **UNIT 1: INTRODUCTION** | 9 |
| Early Grid Activities-Current Grid Activities-An Overview of Grid business Areas-Grid Computing Organizations and Their Roles | |
| **UNIT 2: MESSAGING** | 9 |
| Merging the Grid Services Architecture with the Web Services Architecture: Service-Oriented Architecture - Web Service Architecture–XML Messages and Enveloping | |
| **UNIT 3: OPEN GRID SERVICES** | 9 |
| OGSA–CDC–NFS-Online Media and Entertainment - OGS A Platform Components -Open Grid Services Infrastructure | |
| **UNIT 4: OGSA BASIC SERVICES** | 9 |
| Common Management Model(CMM) -Service domains -Policy Architecture- Security Architecture-Metering and Accounting | |
| **UNIT 5: GLOBUS TOOL KIT** | 9 |
| Architecture- GT3 Software Architecture Model- Programming Model– Service Programming Model-Sample Implementation | |

TOTAL: 45 PERIODS

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

CO1: Define the fundamentals of downstream processing for product recovery

CO2:Understand the requirements for successful operations of downstream processing

CO3 Describe the components of downstream equipment and explain the purpose of each

CO4: Apply principles of various unit operations used in downstream processing and enhance problem solving techniques

CO5: Understand the concept of Globus Toolkit.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 2 | | 2 | | | | 1 | 2 | 2 | | | 2 |
| CO2 | 3 | 2 | 3 | 1 | | | | | | 2 | | 2 | 2 | |
| CO3 | 3 | 1 | 2 | | 1 | | | | 2 | 3 | | 1 | | 1 |
| CO4 | 2 | 3 | 2 | | | | | | | 3 | 2 | | | |
| CO5 | 1 | 3 | 2 | | 1 | | | | 3 | 2 | | 2 | 1 | 2 |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Belter, P.A., E.L. Cussler and Wei-HouhuBioseparations – Downstream Processing for Biotechnology, John Wiley, 1988.

| |
|---|
| 2.Sivasankar, B. Bioseparations: Principles and Techniques. PHI, 2005. |
| 3.Asenjo, Juan A. Separation Processes in Biotechnology. CRC / Taylor and Francis, 1990. |
| **REFERENCE BOOKS:** |
| 1.Ghosh, Raja Principles of Bioseparations Engineering. World Scientific, 2006 |
| 2.Product Recovery in Bioprocess Technology. (BIOTOL – Biotechnology by Open Learning Series). Butterworth – Heinmann / Elsevier, 2004. |
| 3.Frederic Magoules,JiePan,Kiat-An Tan,AbhinitKumar,"Introduction to Grid Computing"CRC Press,2009. |
| **WEB RESOURCES:** |
| 1.https://www.computerworld.com/article/2586983/grid-computing-resources.html |
| 2.hhtps://www.ig-global.com/dictionary/grid-computing/12534 |

| CS606208 - **SECURITY AND PRIVACY IN CLOUD** | | | | | | |
|---|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C | |
| | | 3 | 0 | 0 | 3 | |
| **COURSE OBJECTIVES:** | | | | | | |
| • To understand the concepts of virtualization and virtual machines.<br>• To gain expertise in virtualization infrastructure<br>• To understand architecture and deployment models of cloud computing.<br>• To understand the various services in cloud computing.<br>• To get the idea of security models in the cloud environment | | | | | | |
| **UNIT 1: INTRODUCTION** | | | | | | 9 |
| Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning. | | | | | | |
| **UNIT 2: CLOUD ENABLING TECHNOLOGIES** | | | | | | 9 |
| Service Oriented Architecture – REST and Systems of Systems – Web Services – PublishSubscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU –Memory – I/O Devices –Virtualization Support and Disaster Recovery. | | | | | | |
| **UNIT 3: CLOUD ARCHITECTURE, SERVICES AND STORAGE** | | | | | | 9 |
| Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers | | | | | | |
| **UNIT 4: RESOURCE MANAGEMENT AND SECURITY IN CLOUD** | | | | | | 9 |
| Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges –Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM –Security Standards. | | | | | | |
| **UNIT 5: CLOUD TECHNOLOGIES AND ADVANCEMENTS** | | | | | | 9 |
| Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine — Open Stack –Federation in the Cloud – Four Levels of Federation –Federated Services and Applications – Future of Federation. | | | | | | |
| TOTAL: 45 PERIODS | | | | | | |
| **COURSE OUTCOMES:** At the end of the course, the student will be able to | | | | | | |
| CO1: Deploy the concepts of virtualization strategies and virtual machines | | | | | | |
| CO2: Apply the concept of virtualization infrastructure in the cloud computing | | | | | | |
| CO3: Identify the architecture and deployment models of cloud computing | | | | | | |
| CO4: Develop cloud services using cloud computing for real time environment | | | | | | |
| CO5 Apply the security models in the cloud environment | | | | | | |
| **CO-PO MAPPING** | | | | | | |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | 1 | | | | | 3 | 1 | | 2 | 2 |
| CO2 | 2 | 3 | 2 | 1 | | | | | | 2 | | 2 | 2 | |
| CO3 | 1 | 3 | 3 | | 1 | | | | | 2 | 2 | 1 | | 2 |
| CO4 | 2 | 3 | 1 | | 2 | | | | | 3 | | | | |
| CO5 | 1 | 2 | 3 | 1 | | | | | | 3 | 2 | | 1 | 1 |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Chopra, Rajiv "Cloud Computing", New Age International (P) Ltd Publishers, First Edition, 2017

2.Tim Mather,Subra Kumaraswamy,Shahed Latif."Cloud Security and Privacy-An Enterprise Perspective on Risks and Compliance"Shroff Publishers,First Edition,2009.

3.Siani Pearson , George Yee , "Privacy and Security for Cloud Computing" Springer,2013.

**REFERENCE BOOKS:**

1.Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A PracticalApproach", McGraw-Hill Osborne Media., 2009.

2.Barrie Sosinsky, "Cloud Computing Bible", Kindle Edition, Wiley Publication, 2011.

3.Natte Jenner," CloudSecurity: Introduction to CloudSecurity and Data Protection" Createspace Independent Pub,2018.

**WEB RESOURCES:**

1.https://www.mdpi.com/1999-5903/14/1/11

2.http://pubs.sciepub.com/ajss/4/1/2/index.html.

CS606209 - **IOT AND CLOUD**

| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To understand Smart Objects and loT Architectures.
- To learn about various !OT-related protocols
  To build simple IoT Systems using Arduino and Raspberry Pi..
- To understand data analytics and cloud in the context of loT
- To develop loT infrastructure for popular applications

| **UNIT 1: FUNDAMENTALS OF loT** | 9 |
|---|---|

Evolution of Internet of Things - Enabling Technologies - loT Architectures: oneM2M, loT World Forum (loTWF) and Alternative loT models - Simplified loT Architecture and Core loT Functional Stack - Fog, Edge and Cloud in loT - Functioral blocks of an loT ecosystem - Sensors, Actuators, Smart Objects and Connecting Smart Objects

| **UNIT 2: loT PROTOCOLS** | 9 |
|---|---|

loT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11 ah and LoRaWAN - Network Layer: IP versions, Constrained Nodes and Constrained Networks - Optimizing IP for loT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks - Application Transport Methods: Supervisory Control and Data Acquisition - Application Layer Protocols: CoAP and MQTT

| **UNIT 3: DESIGN AND DEVELOPMENT** | 9 |
|---|---|

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - loT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

| **UNIT 4: DATA ANALYTICS AND SUPPORTING SERVICES** | 9 |
|---|---|

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest - Role of Machine Learning - No SQL Databases - Hadoop Ecosystem - Apache Kafka, Apache Spark - Edge Streaming Analytics and Network Analytics - Xively Cloud for loT, Python Web Application Framework - Django -AWS for loT - System Management with NETGONF-YANG

| **UNIT 5: CASE STUDIES/INDUSTRIAL APPLICATIONS** | 9 |
|---|---|

Cisco loT system - IBM Watson loT platform - Manufacturing - Converged Plantwide Ethernet Model (CPwE) - Power Utility Industry - GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

TOTAL: 45 PERIODS

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

CO1: Understand the concept of loT.

CO2:Analyze various protocols for loT

CO3 : Design a Poe of an +o'T system using Rasperry Pi/Arduino

CO4: Apply data analytics and use cloud offerings related to loT

CO5: Analyze applications of IoT in real time scenario

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 3 | | 2 | | | | | 2 | | | | 1 |
| CO2 | 3 | 2 | 3 | | | | | | | 3 | 2 | 1 | 2 | 2 |
| CO3 | 2 | 3 | 3 | | 3 | | | | | 2 | 1 | | 1 | |
| CO4 | 3 | 2 | 2 | | | | | | | 2 | 1 | 2 | | 1 |
| CO5 | 2 | 2 | 3 | | 1 | | | | | 3 | | 2 | 2 | |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.David Hanes, Gonzalo Salgueiro, Patrick Grossetete. Rob Barton and Jerome Henry, "loT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

2. ArshdeepBahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖, Universities Press, 2015

3. Olivier Hersent, David Boswarthick, Omar Elloumi, ―The Internet of Things – Key applications and Protocols‖, Wiley, 2012 (for Unit 2)

**REFERENCE BOOKS:**

1.Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.

2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things‖, Springer, 2011.

3. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance your projects, 2nd Edition, O'Reilly_Media,2011.

**WEB RESOURCES:**

1.https://www.geeksforgeeks.org/iot-and-cloud-computing/amp/

2.https://www.knowledgehut.com/blog/cloud-computing/cloud-computing-and-internet-of-things

| CS606210 - **GOOGLE CLOUD COMPUTING FOUNDATIONS (NPTEL)** | | | | | | |
|---|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C | |
| | | 3 | 0 | 0 | 3 | |

**COURSE OBJECTIVES:**

- To discuss the fundamental concepts of google cloud computing.
- To know about cloud functions and its applications
- To simulate the software query language with google cloud.
- To get the knowledge of cloud application programming interface
- To describe the security issues of google cloud computing with virtual private networks.

| **UNIT 1: INTRODUCTION** | 9 |
|---|---|

Introduction to Cloud - Cloud Computing - Cloud vs Traditional Architecture - Iaas, PaaS and SaaS - Google Cloud Architecture -Cloud Computing Recap Quiz - Summary - Cloud Computing - Introduction - Start with a Solid Platform - The GCP Console - Understanding Projects - Billing in GCP - Install and Configure Cloud SDK - Use Cloud Shell [With Labs] - GCP APIs - Cloud Console Mobile App - Recap Quiz - Start with a Solid Foundation

| **UNIT 2: CLOUD FUNCTIONS** | 9 |
|---|---|

Introduction-Compute Options in the Cloud-Exploring IaaS with Compute Engine [With Lab]-Configuring Elastic Apps with Autos calling-Exploring PaaS with App Engine [With Lab]-Event Driven Programs with Cloud Functions [With Lab]-Containerizing and Orchestrating Apps with GKE-Summary

| **UNIT 3: SOFTWARE QUERY LANGUAGE** | 9 |
|---|---|

Introduction-Storage Options in the Cloud-Structured and Unstructured Storage in the Cloud-Unstructured Storage using Cloud Storage [With Lab]- SQL Managed Services-Exploring Cloud SQL [With Lab]-Cloud Spanner as a Managed Service-No SQL Managed Services Options-Cloud Data store a No SQL Document Store [With Lab]-Cloud Big table as a No SQL Option-Summary

| **UNIT 4: APPLICATION PROGRAMMING INTERFACE** | 9 |
|---|---|

Introduction to API-The Purpose of APIs-Cloud Endpoints [With Lab]-Using Apigee-Managed Message Services-Cloud Pub/Sub [With Lab]-Recap Quiz - There's an API for that!-Introduction - Cloud Security-Introduction to security in the cloud-Understanding the shared security model-Explore encryption options-Understand authentication and authorization [With Lab]-Identify best practices for authorization-Recap Quiz Security-Summary - Security.

| **UNIT 5: GOOGLE CLOUD SECURITY** | 9 |
|---|---|

Introduction-Intro to Networking in the Cloud-Defining a Virtual Private Cloud-Public and Private IP Address Basics-Googles Network Architecture-Routes and Firewall Rules in the Cloud [With Lab]- Multiple VPC Networks [With Lab]-Building Hybrid Clouds-Different Options for Load Balancing [With Labs]-Recap Quiz-Summary

TOTAL: 45 PERIODS

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

CO1 : Build the fundamental concepts of google cloud computing

CO2 : Handle about cloud functions and its applications

CO3 : Develop the software query language with google cloud.

CO4 : Integrate the knowledge of cloud application programming interface

CO5 : Access the security issues of google cloud computing with virtual private networks.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | | | | | | 2 | 3 | | | 3 | |
| CO2 | 3 | 3 | 2 | | | | | | 3 | 3 | | | 2 | 2 |
| CO3 | 3 | 2 | 3 | | | | | | 2 | 2 | | | 3 | 3 |
| CO4 | 2 | 3 | 2 | | | | | | 3 | 2 | | | | 2 |
| CO5 | 3 | 2 | 2 | | | | | | 2 | 3 | | | 3 | |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Prof.Soumya Kanti Ghosh, "Google Cloud Computing Foundations" IIT Kharagpur,2020.

2.Praveen Kukreti , "Google Cloud Platform – All-In-One-Guide",bpb Publisher,2023.

3.Patrick Haggerty , "The Ultimate Guide to Building a Google Cloud Foundation",Packt Publishing,2022.

**REFERENCE BOOKS:**

1.Alasdair Gilchrist , "Google Cloud Platform an Architect's Guide"

2.Adney Ainsley , "Google Cloud Platform" – The Ultimate Guide for Beginners,2020.

3.Valarie Lestourgeon , "A Beginner's Guide To Google Cloud Computing"2021.

**WEB RESOURCES:**

1.https://www.cloudskillsboost.google/course_templates/153

2.https://alison.com/courses/google-cloud-computing-foundation/resources

# VERTICAL III
# CYBER SECURITY

| CS606301-Ethical Hacking (NPTEL) | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **COURSE OBJECTIVES:** | | | | | |
| • To gain an idea about how to analyseremote device.<br>• To compare and contrast various Wireless Access Point attacks<br>• To understand password cracking using different tools<br>• To apply ethical theories to a cyber-related issue<br>• To learn some techniques for launching server attacks | | | | | |

**Week 1** Module 1: Introduction to ethical hacking | Module 2: Fundamentals of computer networking | Module 3: TCP/IP protocol stack.

**Week 2** Module 1: IP addressing and routing | Module 2: Routing protocols

**Week 3** Module 1: Introduction to network security | Module 2: Information gathering: reconnaissance, scanning, etc

**Week 4** Module 1: Vulnerability assessment: OpenVAS, Nessus, etc| Module 2: System hacking: password cracking, penetration testing, etc.

**Week 5** Module 1: Social engineering attacks | Module 2: Malware threats | Module 3: penetration testing by creating backdoors

**Week 6** Module 1: Introduction to cryptography | Module 2: private-key encryption | Module 3: public-key encryption

**Week 7** Module 1: Key exchange protocols | Module 2: cryptographic hash functions | Module 3: applications

**Week 8**Module 1: Steganography, biometric authentication | Module 2: lightweight cryptographic algorithms

**Week 9**Module 1: Sniffing: Wire shark, | Module 2: ARP poisoning | Module 3: DNS poisoning | Module 4: Hacking wireless networks | Module 5: Denial of service attacks

**Week 10** Module 1: Elements of hardware security: side-channel attacks, | Module 2: physical unclonable functions

**Week 11** Module 1: Hacking web applications: vulnerability assessment, | Module 2: SQL injection, cross-site scripting.

**TOTAL: 45 PERIODS**

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

CO1: Idea about how to analyse remote device

CO2: Compare and contrast various Wireless Access Point attacks

CO3: Understand password cracking using different tools

CO4: Apply ethical theories to a cyber-related issue

CO5: learn some techniques for launching server attacks

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | 2 | | | | | | 2 | | 2 | | |
| CO2 | 3 | 3 | | 3 | | | | | | 2 | | 2 | 1 | 1 |
| CO3 | 3 | 3 | 2 | | | | | | | 2 | | 2 | | |
| CO4 | 3 | 3 | 3 | 3 | | | | | | 2 | | 2 | 1 | |
| CO5 | 3 | 3 | 3 | 3 | | | | | | 2 | | 2 | | 1 |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.**Hacking: The Art of Exploitation**," Jon Erickson", Second Edition, Pearson Education

2**. The Basics of Hacking and Penetration Testingby Patrick**Engebretson, Second Edition, Pearson Education

| |
|---|
| **3. The Web Application Hacker's Handbook By** DafyddStuttard |
| **REFERENCE BOOKS:** |
| 1.The Hacker Playbook 2 byPeter Kim, 1st Edition |
| 2.Georgia Weidman, "Penetration Testing", First Edition, PHI Learning Private Limited, 2012. |
| **WEB RESOURCES:** |
| https://www.synopsys.com/glossary/what-is-ethical-hacking.html#:~:text=Definition,and%20actions%20of%20malicious%20attackers. |
| https://www.eccouncil.org/cybersecurity/what-is-ethical-hacking/ |

| CS606302-Digital and Mobile Forensics | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To understand the role of investigator and lab requirements in Digital Forensics.
- To analyse the Data Acquisition methods, tools and storage formats of digital evidence.
- To classify the Collecting, Preserving and Seizing of various digital evidences
- To apply the Validating and Testing of evidences using various methods.
- To understand the techniques in developing standard methods of network forensics

| **UNIT 1: COMPUTER FORENSICS AND INVESTIGATIONS** | **9** |
|---|---|
| Understanding Computer Forensics, Preparing for Computer Investigations, Taking A Systematic Approach, Procedure for Corporate High- Tech Investigations, Understanding Data Recovery Workstations and Software Office and Laboratory: Understanding Forensics Lab Certification Requirements Determining the Physical Requirements for a Computer, Forensics Lab Selecting a Basic Forensic Workstation | |
| **UNIT 2: INTENTS AND SERVICES** | **9** |
| Understanding Storage Formats for Digital Evidence, Determining the Best Acquisition Method, Contingency Planning for Image Acquisitions, Using Acquisition Tools, Validating Data Acquisition, Performing RAID Data Acquisition, Using Remote Network Acquisition Tools, Using Other Forensics Acquisition Tools | |
| **UNIT 3: WEB COMMUNICATION AND TELEPHONY** | **9** |
| Identifying Digital Evidence, Collecting the Evidence in Private-Sector Incident Scenes, Processing law Enforcement Crime Scenes, preparing for a Search, Securing a Computer Incident or Crime Scene, Seizing Digital evidence at the crime Scene, Storing Digital evidence, Obtaining a Digital Hash, Current Computer Forensics Tools, Evaluating Computer Forensics Tool Needs, Computer Forensics Software Tools, Computer Forensics Hardware Tools | |
| **UNIT 4: GRAPHICS AND MULTIMEDIA** | **9** |
| Forensics Software Computer Forensics Analysis and Validation, Determining What Data to Collect and Analyze, Validating Forensic Data, Addressing Data-Hiding Techniques, Performing Remote Acquisition, data carving, Recovering Graphics and Network Forensics, Recognizing a Graphics File, Understanding Data Compression, Locating and Recovering Graphics Files, live Memory forensics (RAM), Understanding Copyright Issues with Graphics, Network Forensic, social media forensics. | |
| **UNIT 5: SECURITY AND HACKING** | **9** |
| Developing Standard Procedure for Network Forensics, Using Network Tools, Examining Honey net Project, E-mail Investigations, Cell Phone and Mobile Device Forensics, Exploring the Role of E- mail in Investigations, Exploring the Role of Client and Server in E-mail, Investigating E-mail Crimes and Violations, Understanding E-mail Servers, Using Specialized E-mail Forensics Tools, Understanding Mobile Device Forensics, Understanding Acquisition Procedure for Cell Phones and Mobile Devices**TOTAL: 45 PERIODS** | |

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

CO1:Understand the role of investigator and lab requirements in Digital Forensics.

CO2 : Analyze the Data Acquisition methods, tools and storage formats of digital evidence

CO3 : Classify the Collecting, Preserving and Seizing of various digital evidences

CO4 : Apply the Validating and Testing of evidences using various methods

CO5 : Understand the techniques in developing standard methods of network forensics

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | | 1 | | 2 | 1 | | | 2 | | | 1 | |
| CO2 | 2 | 1 | | | 3 | 1 | 1 | | | 2 | | | | 1 |
| CO3 | 2 | | 3 | 1 | 2 | 1 | | 1 | | 2 | | | | |
| CO4 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | | | 2 | | | | |
| CO5 | 1 | 2 | 1 | 2 | 2 | 1 | | 1 | | 2 | | | | 1 |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Guide to computer forensics and investigation 3rd or 4th edition by Amelia Philips, Bill Nelsonand Christopher Steuart.

**REFERENCE BOOKS:**

1.https://www.coursehero.com/file/p3ip151/Understanding-Data-Recovery-Workstationsand-Software-Investigations-are/"

2.https://www.intaforensics.com/2012/01/20/understanding-the-computer-forensics-process"

**WEB RESOURCES:**

https://www.geeksforgeeks.org/mobile-forensics-definition-uses-and-principles/

https://securityscorecard.com/blog/what-is-mobile-forensics-a-real-example-from-the-securityscorecard-forensics-lab/

| CS606303-Systems and Usable Security (NPTEL) | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **COURSE OBJECTIVES:** | | | | | |

- To learn how to design and analyse usability studies
- To overview of the definitions of privacy as well as some of the legal and social aspects of it.
- To analyse of common privacy issues and how they are expressed through user interaction with systems.
- To discuss of ethics, particularly around research in topics in security and privacy where participants can be particularly vulnerable.
- To test and work with a system security

**WEEK 1**

Introduction: Computer security concepts, threats, attacks Malicious Software: Types of Malicious Software (Malware), Vulnerability, Exploits, Social Engineering–SPAM E-mail, Zombie, Bots, Keyloggers, Phishing, Spyware.

**WEEK 2**

Operating System Security: System Security Planning, Application Security, Linux/Unix Security, Windows Security, Virtualization Security

**WEEK 3**

Web Security: Secure E-mail and S/MIME, Domain Keys Identified Mail, Secure Sockets Layer (SSL) and Transport Layer Security (TLS), HTTPS, IPv4 and IPv6 Security, Public-Key Infrastructure and Federated Identity Management.

**WEEK 4**

Usable Security: Introduction to Privacy, Trust and Semantic Security, Visualizing Privacy, Web Browser Security and Privacy, Authentication and Text Passwords, Biometrics and Graphical Passwords.

**TOTAL: 45 PERIODS**

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

CO1: Learn how to design and analyse usability studies

CO2: Overview of the definitions of privacy as well as some of the legal and social aspects of it.

CO3: Analyse of common privacy issues and how they are expressed through user interaction with systems

CO4: Discuss of ethics, particularly around research in topics in security and privacy where participants can be particularly vulnerable.

CO5: Test and work with a system security

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | | 1 | | 1 | 1 | | | | | | | |
| **CO2** | 2 | 2 | | 1 | | 2 | 1 | 1 | | | | | | |
| **CO3** | 3 | 1 | 2 | 2 | 1 | 1 | | 1 | | | | | | |
| **CO4** | 1 | | 3 | 2 | 2 | 1 | | 1 | | | | | | |
| **CO5** | 2 | 1 | | 2 | 2 | 1 | 1 | | | | | | 1 | 1 |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.John Slavio, "Hacking: A Beginners' Guide to Computer Hacking, Basic Security, And Penetration Testing", O'Reilly Media, 3rd Edition, 2013

2.RaefMeeuwisse,"CybersecurityforBeginners,May 14, 2015 by Lulu Publishing Services.

**REFERENCE BOOKS:**

1.Hacking for Beginners: A Step By Step Guide For You To Learn the Basics of Cyber security And Hacking - Ramon Nastase ,August 6, 2018 by Independently Published

2.The Code Book: The Science of Secrecy from Ancient Egypt to Quantum Cryptography - Simon Singh, August 15, 2011 by Little, Brown and Company

**WEB RESOURCES:**

1.https://www.knowledgehut.com/blog/security/best-book-on-cyber-security

2.https://www.simplilearn.com/tutorials/cyber-security-tutorial/cyber-security-books

| CS606304-Modern Cryptography | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To understand basics of Cryptography and Network Security.
- To be able to secure a message over insecure channel by various means.
- To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
- To understand various protocols for network security to protect against the threats in the networks.
- To learn the IP Security

| | |
|---|---|
| **UNIT 1:** Introduction to Cryptography and Block Ciphers | **9** |
| Introduction to security attacks - services and mechanism - introduction to cryptography - Conventional Encryption: Conventional encryption model - classical encryption techniques - substitution ciphers and transposition ciphers – cryptanalysis – steganography - stream and blockciphers - Modern Block Ciphers: Block ciphers principals - Shannon's theory of confusion anddiffusion - fiestal structure - data encryption standard(DES) - strength of DES - differential and linearcrypt analysis of DES - block cipher modes of operations - triple DES – AES. | |
| **UNIT 2:** Confidentiality and Modular Arithmetic | **9** |
| Confidentiality using conventional encryption - traffic confidentiality - key distribution - random number generation - Introduction to graph - ring and field - prime and relative prime numbers - modular arithmetic - Fermat's and Euler's theorem - primality testing - Euclid's Algorithm - Chinese Remainder theorem - discrete algorithms. | |
| **UNIT 3:** Public key cryptography and Authentication requirements) | **9** |
| Principles of public key crypto systems - RSA algorithm - security of RSA - key management – Diffle-Hellman key exchange algorithm - introductory idea of Elliptic curve cryptography – Elgamel encryption - Message Authentication and Hash Function: Authentication requirements - authentication functions - message authentication code - hash functions - birthday attacks – security of hash functions and MACS. | |
| **UNIT 4:** (Integrity checks and Authentication algorithms) | **9** |
| MD5 message digest algorithm - Secure hash algorithm (SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm - Authentication Applications: Kerberos and X.509 - directory authentication service - electronic mail security-pretty good privacy (PGP) - S/MIME. | |
| **UNIT 5:** IP Security and Key Management | **9** |
| IP Security: Architecture - Authentication header - Encapsulating security payloads - combining security associations - key management. | |
| **TOTAL: 45 PERIODS** | |

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

CO1: Understand basics of Cryptography and Network Security.

CO2: Understand the secure a message over insecure channel by various means.

CO3: Classify how to maintain the Confidentiality, Integrity and Availability of a data.

CO4: understand various protocols for network security to protect against the threats in the networks.

CO5:Apply IP Security methods

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | | | | | | | | 1 | | 1 | | |
| CO2 | 1 | | | | | | | | | 1 | | 1 | | |
| CO3 | 1 | 1 | 1 | | | | | | | 1 | | 1 | | |
| CO4 | 1 | 1 | 1 | | | | | | | 1 | | 1 | | 1 |
| CO5 | 1 | 1 | 1 | | | | | | | 1 | | 1 | 1 | 1 |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.William Stallings, "Crpyptography and Network security Principles and Practices", Pearson/PHI. 2. Wade Trappe, Lawrence C Washington, " Introduction to Cryptography with coding theory", Pearson.

**REFERENCE BOOKS:**

1.W.Mao, "Modern Cryptography – Theory and Practice", Pearson Education. 2. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India.

**WEB RESOURCES:**

1.https://www.tutorialspoint.com/cryptography/modern_cryptography.htm

2.http://staff.ustc.edu.cn/~mfy/moderncrypto/reading%20materials/Introduction_to_Modern_Cryptography.pdf

| CS606305-Engineering Secure software systems | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- Demonstrate knowledge of the distinction between critical and non-critical systems.
- Demonstrate the ability to manage a project including planning, scheduling and risk assessment/management.
- Remember a software requirements document.
- Demonstrate an understanding of the proper contents of a software requirements document.
- Remember a formal specification for a software system.

**UNIT 1: Security a software Issue** **9**

Introduction, the problem, Software Assurance and Software Security, Threats to software security, Sources of software insecurity, Benefits of Detecting Software Security What Makes Software Secure: Properties of Secure Software, Influencing the security properties of software, Asserting and specifying the desired security properties?

**UNIT 2:Requirements Engineering for secure software** **9**

Introduction, the SQUARE process Model, Requirements elicitation and prioritization

**UNIT 3: Secure Software Architecture and Design** **9**

Introduction, software security practices for architecture and design: architectural risk analysis, software security knowledge for architecture and design: security principles, security guidelines and attack patterns Secure coding and Testing: Code analysis, Software Security testing, Security testing considerations throughput the SDLC

**UNIT 4: Security and Complexity** **9**

System Assembly Challenges: introduction, security failures, functional and attacker perspectives for security analysis, system complexity drivers and security

**UNIT 5: Governance and Managing for More Secure Software** **9**

Governance and security, Adopting an enterprise software security framework, How much security is enough, Security and project management, Maturity of Practice

**TOTAL: 45 PERIODS**

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

CO1:Apply contemporary techniques to model and analyze the security of a software system

CO2: Identify project security risks & selecting risk management strategies.

CO3: Use statistical methods to collect and analyze metrics for assessing and improving the security of a product, process, and project objectives.

CO4:Describe and discuss security concerns designs at multiple levels of abstraction

CO5: Comply with data privacy and security requirements when designing a software system.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | | | | | | | | 2 | | 2 | | |
| CO2 | 2 | 2 | | | | | | | | 2 | | 2 | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO3 | 2 | 2 | | | | | | 1 | | 2 | | 2 | | |
| CO4 | 2 | 2 | | | | | | 1 | | 2 | | 2 | | |
| CO5 | 2 | 2 | | | | | | | | 2 | | 2 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Software Security Engineering: Julia H. Allen, Pearson Education

**REFERENCE BOOKS:**

1.Developing Secure Software: Jason Grembi, Cengage Learning

2.Software Security : Richard Sinn, Cengage Learning

**WEB RESOURCES:**

1.https://resources.sei.cmu.edu/library/asset-view.cfm?assetid=513522

2.https://www.coursera.org/lecture/software-security/designing-and-building-secure-software-introduction-kUWem

| CS606306-Crypto currency and Block chain Technologies | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **COURSE OBJECTIVES:** | | | | | |

- To understand the basic concepts and technology used for blockchain.
- To learn the primitives of the distributed computing and cryptography related to blockchain.
- To Illustrate the concepts of Bitcoin and their usage
- To Implement Ethereum block chain contract
- To Apply security features in blockchain technologies

| | |
|---|---|
| **UNIT 1: INTRODUCTION** | **9** |
| Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Nakamoto's concept with Blockchain based cryptocurrency, Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc | |
| **UNIT 2 : BASIC DISTRIBUTED COMPUTING & CRYPTO PRIMITIVES** | **9** |
| Atomic Broadcast, Consensus, Byzantine Models of fault tolerance, Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems | |
| **UNIT 3: ETHEREUM BASICS** | **9** |
| Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts, Writing smart contracts using Solidity & JavaScript | |
| **UNIT 4: PRIVACY, SECURITY ISSUES IN BLOCKCHAIN** | **9** |
| Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains: Sybil attacks, selfish mining, 51% attacks advent of algorand; Sharding based consensus algorithms to prevent these attacks | |
| **UNIT 5: CASE STUDIES** | **9** |
| Block chain in Financial Service, Supply Chain Management and Government Services | |
| **TOTAL: 45 PERIODS** | |
| **COURSE OUTCOMES:** At the end of the course, the student will be able to | |
| CO1: Describe the basic concepts and technology used for block chain. | |
| CO2: Describe the primitives of the distributed computing and cryptography related to block chain. | |
| CO3: Illustrate the concepts of Bitcoin and their usage. 4. Implement Ethereum block chain contract. | |
| CO4: Implement Ethereum block chain contract | |
| CO5: Apply security features in block chain technologies. | |
| | |
| **CO-PO MAPPING** | |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 1 | | 1 | | 2 | 2 | 1 | | 1 | | | |
| CO2 | 2 | 3 | 2 | 3 | 1 | | 1 | 1 | | | 2 | | | |
| CO3 | 1 | 2 | 3 | 3 | 2 | | 2 | 1 | 2 | | 2 | | | |
| CO4 | 2 | 1 | 2 | 2 | 2 | | 2 | 1 | | | 1 | | 1 | |
| CO5 | 1 | | 2 | 2 | 2 | | 3 | 1 | 2 | | 2 | | 1 | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Ramayana, Bonneau, Felten, Miller and Goldfeder, "Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction", Princeton University Press.

2.Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.

3.Imran Bashir, "Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained", Packt Publishing.

**REFERENCE BOOKS:**

1.MerunasGrincalaitis, "Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols", Packt Publishing.

2.Prof.SandipChakraborty, Dr. Praveen Jayachandran, "Blockchain Architecture Design And Use Cases"[MOOC], NPTEL: https://nptel.ac.in/courses/106/105/106105184/

**WEB RESOURCES:**

1.https://www.pwc.com/us/en/industries/financial-services/fintech/bitcoin-blockchain-cryptocurrency.html

2.https://online.stanford.edu/courses/xcs251-cryptocurrencies-and-blockchain-technologies

| CS606307-Cryptography And Network Security (NPTEL) | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To understand the most common type of cryptographic algorithm ·
- To understand the Public-Key Infrastructure ·
- To understand security protocols for protecting data on networks ·
- To be able to digitally sign emails and files ·
- To understand vulnerability assessments and the weakness of using passwords for authentication

**WEEK1:** Introduction to cryptography, Classical Cryptosystem, Block Cipher.

**WEEK2:**Data Encryption Standard (DES), Triple DES, Modes of Operation, Stream Cipher.

**WEEK3:** LFSR based Stream Cipher, Mathematical background, Abstract algebra, Number Theory.

**WEEK4:** Modular Inverse, Extended Euclid Algorithm, Fermats Little Theorem, Euler Phi-Function

**WEEK5:**Advanced Encryption Standard (AES), Introduction to Public Key Cryptosystem, Diffie-Hellman Key Exchange

**WEEK6:** Primarily Testing, ElGamal Cryptosystem, Elliptic Curve over the Reals,

**WEEK7:** Generalized ElGamal Public Key Cryptosystem, Rabin Cryptosystem.

**WEEK8:** Cryptographic Hash Function, Secure Hash Algorithm (SHA), Digital Signature Standard (DSS).

**WEEK9:** Cryptanalysis, Time-Memory Trade-off Attack, Differential and Linear Cryptanalysis

**WEEK 10:**Cryptanalysis on Stream Cipher, Modern Stream Ciphers, Shamirs secret sharing and BE, Identity-based Encryption (IBE)

**WEEK 11:** Side-channel attack, The Secure Sockets Layer (SSL), Pretty Good Privacy (PGP), Introduction to Quantum Cryptography

**TOTAL: 45 PERIODS**

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

CO1:Understand the most common type of cryptographic algorithm ·

CO2:Understand the Public-Key Infrastructure ·

CO3:Understand security protocols for protecting data on networks ·

CO4:Be able to digitally sign emails and files ·

CO5:Understand vulnerability assessments and the weakness of using passwords for authentication

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | | | | | | | 2 | | | | |
| CO2 | 2 | 3 | 3 | | | | | | | 2 | | | | |
| CO3 | 2 | | 2 | 3 | 3 | | | | | 2 | | | | |
| CO4 | | 2 | 3 | | 2 | | | | | 2 | | | | |
| CO5 | | 2 | 2 | | 3 | | | | | 2 | | | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

| |
|---|
| 1.William Stallings , “Cryptography and Network security”, Pearson Education, 4th ed., |
| **REFERENCE BOOKS:** |
| 1.WilliamStallings, “Network Security Essentials Applications and Standards”, 2nd ed., Pearson Education, 2003. |
| 2.Charlie Kaufman, Radis Perlman and Mike Speciner, “Network Security – Private Communication in a Public World” 2nd ed., Pearson Education, 2003 |
| **WEB RESOURCES:** |
| 1.https://rguktrkv.ac.in/curriculampdf/CS3505.pdf |
| 2.https://www.gvpce.ac.in/syllabi/Cryptography%20and%20Network%20Security.pdf |

| CS606308-Network Management | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To understand the basic concepts in networking
- To understand the various network protocols and effective representation of multimedia data.
- To learn the congestion control and avoidance techniques and how to secure the data transmission.
- To learn the network management technologies and tools.
- To understand the network management applications

| | |
|---|---|
| **Unit 1 FOUNDATION FOR NETWORKS** | **9** |
| Introduction - Architecture - Framing - Error Detection - Ethernet and Multiple Access Networks - Wireless Networks - Internetworking: Switching and Bridging, Basic Internetworking (IP), Routing – Advanced Internetworking: Global Internet, Multicast, Routing Among Mobile Devices | |
| **Unit 2 PROTOCOLS AND DATA REPRESENTATION** | **9** |
| End-to-End Protocols: UDP, TCP, RPC, Transport for Real Time Applications - End-to-End Data: Presentation Formatting: Taxonomy, Markup Languages - Multimedia Data Lossless Compression Techniques - Image Representation and Compression - Video Compression - Audio Compression | |
| **Unit 3 CONGESTION CONTROL AND NETWORK SECURITY** | **9** |
| Congestion Control**:** Effects of Congestion - Congestion and Control - TCP Congestion Control - Congestion Avoidance Schemes Issues in Resource Allocation - Traffic Management - TCP Traffic Control -TCP Flow Control - Network Security: Cryptographic Building Blocks - Key Pre Distribution -Authentication Protocols | |
| **Unit 4 DATA COMMUNICATION AND NETWORK MANAGEMENT** | **9** |
| Data and Tele communication Network-Distributed Computing Environment -TCP/IP-Based Networks: Internet and Intranet-Communication Protocols and Standards-Networks, Systems, and Services-System and Service Management-Challenges of IT Managers-Network Management: Goals, Organization, and Functions-Network Management Architecture and Organization-Network Management Perspectives Section-NMS Platform Section-Current Status and Future of Network Management. | |
| **Unit 5 NETWORK MANAGEMENT APPLICATIONS** | **9** |
| Configuration Management - Fault Management-Performance Management-Event Correlation Techniques-Security Management-Accounting Management- Report Management-Policy-Based Management -service Level Management. | |
| **TOTAL: 45 PERIODS** | |

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

CO1: Acquire knowledge about the developments in the area of Networking

CO2: understand the different network management tools and techniques

CO3: apply the networking principles to design a network

CO4: Develop network applications in various platforms

CO5: understand the network management applications

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 3 | | | | | | | 2 | | | | |
| CO2 | 2 | 3 | 3 | | | | | | | 2 | | | | |
| CO3 | 2 | | 2 | | | | | | | 2 | | | | |
| CO4 | | 2 | 3 | | | | | | | 2 | | | | |
| CO5 | | 2 | 2 | | | | | | | 2 | | | 1 | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Larry L. Peterson and Bruce S. Davie, "Computer Networks - A systems Approach", Morgan Kaufmann publications, Fifth Edition, 2011. (UNIT I, II, III)

2.Mani Subramanian, "Network Management - Principles and Practice", Pearson Education, Second Edition, 2010. (UNIT IV,V)

**REFERENCE BOOKS:**

1.Stallings. W, "High Speed Networks and Internets: Performance and Quality of service", Prentice Hall, Second Edition, Seventh Impression, 2008

2.Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw-Hill Second Edition, 2006

**WEB RESOURCES:**

1.https://www.cisco.com/c/en/us/solutions/enterprise-networks/what-is-network-management.html

2.https://www.spiceworks.com/tech/networking/articles/what-is-network-management/

| CS606309-Cyber Crime And Laws | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **COURSE OBJECTIVES:** | | | | | |

- To understand Cyber Crime Attacks
- To learn Denial-of-service (DOS) attack
- To know about Phases of cyber attack
- To learn Different types of tools used in cybercrime
- To learn Prevention of Cyber Crime

| **Unit 1 Introduction** | **9** |
|---|---|
| Cyber Crime- Overview, Internal and External Attacks, Attack Vectors. Cybercrimes against Individuals – E-mail spoofing and online frauds, Phishing and its forms, Spamming, Cyber-defamation, Cyberstalking, Cyber Bullying and harassment, Computer Sabotage, Pornographic offenses, Password Sniffing. Keyloggers and Screenloggers. Cyber Crimes against Women and Children. | |
| **Unit 2 Cybercrime** | **9** |
| Cybercrime against organization – Unauthorized access of computer, Password Sniffing, Denial-of-service (DOS) attack, Backdoors and Malwares and its types, E-mail Bombing, Salami Attack, Software Piracy, Industrial Espionage, Intruder attacks. Security policies violations, Crimes related to Social Media, ATM, Online and Banking Frauds. Intellectual Property Frauds. Cyber Crimes against Women and Children. | |
| **Unit 3 Phases of cyber attack** | **9** |
| A global perspective on cybercrimes, Phases of cyber attack – Reconnaissance, Passive Attacks, Active Attacks, Scanning, Gaining Access, Maintaining Access, Lateral movement and Covering Tracks. Detection Avoidance, Types of Attack vectors, Zero-day attack, Overview of Network based attacks. | |
| **Unit 4 Attacks** | **9** |
| Cybercrime and cloud computing, Different types of tools used in cybercrime, Password Cracking – Online attacks, Offline attacks, Remote attacks, Random Passwords, Strong and weak passwords. Viruses and its types. Ransomware and Cryptocurrencies. DoS and DDoS attacks and their types. Cybercriminal syndicates and nation state groups. | |
| **Unit 5 Prevention of Cyber Crimes** | **9** |
| Prevention of Cyber Crimes -Critical analysis of the IT Act, 2000 3. International position on Free Speech on Internet- Cyber Crimes: Obscenity, Stalking, Hate Speech 2. Data Theft Hacking, Phishing - Sedition, Privacy, Cyber-terrorism **TOTAL: 45 PERIODS** | |

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

- Understand Cyber CrimeAttacks
- Learn Denial-of-service (DOS) attack
- Classify about Phases of cyber attack
- Design Different types of tools used in cybercrime
- Learn Prevention of Cyber Crime

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | | | | | | | 2 | | | | |
| CO2 | 2 | 3 | 2 | | | | | 2 | | 2 | | | | |
| CO3 | 2 | | | | | 1 | | | | 2 | | | | |
| CO4 | | 2 | 3 | | | | | | | 2 | | | | |
| CO5 | | 2 | 2 | | | | | | | 2 | | | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.NinaGodbole and SunitBelapore; "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publications, 2011.

2. Shon Harris, "All in One CISSP, Exam Guide Sixth Edition", McGraw Hill, 2013. 3. Bill Nelson, Amelia Phillips and Christopher Steuart; "Guide to Computer Forensics and Investigations" – 3 rd Edition, Cengage, 2010 BBS.

3.William Stallings; "Cryptography and Network Security: Principles and Practices", Fifth Edition, Prentice Hall Publication Inc., 2007.

**REFERENCE BOOKS:**

1.Atul Jain; "Cyber Crime: Issues, Threats and Management", 2004. 6. Majid Yar; "Cybercrime and Society Sage Publications, 2006.

2.Michael E Whiteman and Herbert J Mattord; "Principles of Information Security", Vikas Publishing House, New Delhi, 2003. 8. Matt Bishop, "Computer Security Art and Science", Pearson/PHI, 2002

**WEB RESOURCES:**

1.https://blog.ipleaders.in/cyber-crime-laws-in-india/

2.https://legalserviceindia.com/legal/article-9498-an-overview-of-cyber-crimes-and-cyber-laws-in-india.html

| CS606310-Design of Network Router | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **COURSE OBJECTIVES:** | | | | | |

- To recognize the principles of the big picture of computer networks.
- To understand the networking environment.
- To know the importance of VPNs.
- To convey the availability of tools and techniques for networking.
- To discuss about evolving technologies in networks.

| **Unit 1 FUNDAMENTALS OF NETWORK DESIGN** | **9** |
|---|---|
| Design Principles - Determining Requirements - Analyzing the Existing Network - Preparing the Preliminary Design - Completing the Final Design Development - Deploying the Network - Monitoring and Redesigning – Maintaining - Design Documentation - Modular Network Design - Hierarchical Network Design | |
| **Unit 2 UNDERLYING LAN CONCEPTS** | **9** |
| LAN connectivity for small businesses – Integration – Token-Ring – Ethernet – ATM LAN emulation – InterLAN Switching – LAN to Mainframe – Building networks. | |
| **Unit 3 VPNS, INTRANETS AND EXTRANETS** | **9** |
| Virtual Network management and planning – VPNs for small businesses – Secure remote access in VPNs – IPSec VPNs – Integrating data centers with Intranets – Implementing and supporting Extranets. | |
| **Unit 4 NETWORKING TOOLS AND TECHNIQUES** | **9** |
| Trends in data communications – Merits of xDSL technology – Preparing for cable modems - Voice and video on the LAN – Internet voice applications – Building IP PBX telephony network – Fax over IP – Videoconferencing over IP networks | |
| **Unit 5 EVOLVING TECHNOLOGIES** | **9** |
| Prevention of Cyber Crimes -Critical analysis of the IT Act, 2000 3. International position on Free Speech on Internet- Cyber Crimes: Obscenity, Stalking, Hate Speech 2. Data Theft Hacking, Phishing - Sedition, Privacy, Cyber-terrorism | |
| **TOTAL: 45 PERIODS** | |
| **COURSE OUTCOMES:** At the end of the course, the student will be able to | |
| CO1: Understand the principles of networks. | |
| CO2: Interpret LAN concepts and design | |
| CO3: Gain knowledge in evolving technologies. | |
| CO4:Clearly outline the logic behind VPNs. | |
| CO5: Know the importance of tools and techniques in building a network. | |
| | |
| **CO-PO MAPPING** | |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | 3 | | | | | | | | | | | 1 |
| CO2 | | | 2 | | | | | 2 | | | | | | |
| CO3 | 2 | | | | | 1 | | | | | | | | 1 |
| CO4 | | | | | | | | | | 2 | | | 1 | |
| CO5 | | 2 | 2 | | | | | | | 2 | | | 1 | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Gil Held, "Network Design: Principles and Applications (Best Practices)", Auerbach Publications, 1st edition, 2000.

2.Diane Tiare and Catherine Paquet, "Campus Network Design Fundamentals", Pearson Education, 1st edition, 2006.

3.Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann Publishers Inc., 5th edition, 2012.

**REFERENCE BOOKS:**

1.William Stallings, "Data and Computer Communications", Pearson Education, 8th edition, 2016.

2.James F. Kurose, Keith W. Ross, "Computer Networking - A Top-Down Approach Featuring the Internet", Pearson Education, 6th edition, 2012

**WEB RESOURCES:**

1.https://www.networkcomputing.com/networking/network-design-router-vs-switch

2.https://www.sciencedirect.com/topics/computer-science/router-architecture

# VERTICAL IV
# INTERNET OF THINGS

| CS606401 - **INTRODUCTION TO INTERNET OF THINGS (NPTEL)** | | | | | |
|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| **COURSE OBJECTIVES:** | | | | | |

- To describe the Basics of IoT and Networking.
- To Implement the Connectivity of Sensor Networks.
- To Know the Knowledge of Arduino.
- To Implement IoT with Raspberry Pi.
- To determine the data analytics of Cloud Computing.

| **UNIT 1: INTRODUCTION TO IOT** | **9** |
|---|---|
| Introduction to IoT- part-I ,Introduction to IoT-Part- II ,Sensing , Actuation ,Basics of IoT Networking-Part-I , Basics of IoT Networking-Part-II , Basics of IoT Networking- Part-III ,Basics of IoT Networking- Part- IV ,Connectivity Technologies- Part-1 ,Connectivity Technologies- Part-2 . | |
| **UNIT-2 : SENSOR NETWORKS** | **9** |
| Connectivity Technologies- Part-3 ,Connectivity Technologies- Part- 4 , Connectivity Technologies- Part- 5 ,Sensor Networks – I ,Sensor Networks – II , Sensor Networks – III Sensor Networks – IV , Sensor Networks – V , UAV Networks , Machine to Machine Communication . | |
| **UNIT-3 : INTRODUCTION TO ARDUINO** | **9** |
| Interoperability in Internet of Things ,Introduction to Arduino- I , Introduction to Arduino- II , Integration of Sensors and Actuators with Arduino- I ,Integration of Sensors and Actuators with Arduino- II Introduction to Python Programming – I , Introduction to Python Programming – II , Introduction to Raspberry Pi– 1 , Introduction to Raspberry Pi– 2 , Implementation of IoT with Raspberry Pi- I . | |
| **UNIT-4 : IMPLEMENTATION OF IoT** | **9** |
| Implementation of IoT with Raspberry Pi- II,Implementation of IoT with Raspberry Pi- II Software – Defined Networking – Part – I Software – Defined Networking – Part – II,Software-Defined loT Networking - Part- 1 ,Software-Defined loT Networking - Part- 2 Cloud Computing- Fundamentals , Cloud Computing - Service Models , Cloud Computing - Service Management and Security ,Cloud Computing- Case Studies . | |
| **UNIT-5 : CLOUD COMPUTING** | **9** |
| Cloud Computing: Practical Sensor - Cloud – I Sensor - Cloud – II Fog Computing – I Fog Computing – II Smart Cities and Smart Homes, Smart Cities and Smart Homes– II ,Smart Cities and Smart Homes– III , Connected Vehicles-I , Connected Vehicles– II ,Smart Grid-Part–I Smart Grid – Part – II , Industrial Internet of Things– Part–I ,Industrial Internet of Things– Part– II Data Handling and Analytics– Part–I ,Data Handling and Analytics- Part- II .Case Study: Agriculture , Case Study: Healthcare , Activity Monitoring (Case Study) –I Activity Monitoring (Case Study)– II . | |
| | **TOTAL: 45 PERIODS** |
| **COURSE OUTCOMES:** At the end of the course, the student will be able to | |
| CO1: Determine the supporting technologies for design of IoT applications. | |
| CO2: Apply the architecture and core modules for IoT applications. | |
| CO3: Develop IoT applications using embedded systems. | |

CO4: Learn the necessary of framework required for IoT application.

CO5: Apply data analytics for IoT applications.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | | | | | | | 2 | | 2 | 2 | 3 |
| CO2 | 2 | 3 | 2 | | | | | | | 3 | 2 | 2 | 3 | 2 |
| CO3 | 2 | 2 | 2 | | | | | | | 2 | | 3 | 2 | 2 |
| CO4 | 2 | 3 | 3 | | | | | | | 2 | | 2 | 2 | 2 |
| CO5 | 3 | 2 | 2 | | | | | | | 2 | 3 | 3 | 3 | 2 |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Introduction of IoT- Prof.SudipMisra ,Department of Computer Science and Engineering,kharagpur,Published 2021,in India.

2.**CunoPfister** -Getting Started with the Internet of Things: Connecting Sensors and
Microcontrollers to the Cloud (Make: Projects) 1st Edition, Kindle Edition.

3.**Daniel Chew** -The Wireless Internet of Things: A Guide to the Lower Layers 1st Edition,
Kindle Edition,Standards Information Network; 1st edition.

**REFERENCE BOOKS:**

1. S. Misra, A. Mukherjee, and A. Roy, 2020. *Introduction to IoT*. Cambridge University Press.

2. S. Misra, C. Roy, and A. Mukherjee, 2020. *Introduction to Industrial Internet of Things And*Industry *4.0.* CRC Press.

3. DimitriosSerpanos, MarilynWolf, "Internet-of-things (IoT) systems: architectures, algorithms, methodologies", 1stEdition, Springer,UK,2017.

**WEB RESOURCES:**

1.IntroductionTo Internet Of Things (Nptel)- https://archive.nptel.ac.in/courses/106/105/106105166/

2.https://www.amazon.in/dp/1032146753/ref=sr_1_3?dchild=1&keywords=sudip+misra&qid=1627359971&sr=8-3

| CS606402 - **IOT ARCHITECTURE AND FRAMEWORK** | | | | | |
|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To describe the concept and enabling IoT Technologies.
- To apply the knowledge on IoT architecture and modules
- To design Internet of Things with Embedded systems using data analytics
- To Analysis and evaluate the data received through sensors in IOT.
- To Determine the data analytics of IoT system.

**UNIT 1: IOT CONCEPTS AND ENABLING TECHNOLOGIES** **9**

Introduction – Definition and Characteristics of IoT – Benefits of IoT –Physical design of IoT Logical design of IoT –IoT Enabling Technologies–Resource Management – Resource Partitioning – Computation Offloading – Identification and Resource/Service Discovery– IoT Levels.

**UNIT 2: IOT ARCHITECTURE AND ITS CORE MODULES** **9**

Reference architecture for IoT – SOA based & API oriented architecture – Four layer architecture – Seven Layer architecture – fog computing – Open stack cloud architecture – Gateways, Edge Devices, Data acquisition systems, Cloud services.

**UNIT 3: EMBEDDED PROTOTYPING OF IOT** **9**

Overview of Raspberry Pi – General-Purpose Input/Outputs – Sensors with Raspberry Pi – Actuators with Raspberry –Web Server with Raspberry Pi – Raspberry Pi as a Database Server ESP8266 Wi-Fi Module – Block Diagram, Features, applications.

**UNIT 4: IOT FRAME WORK & INDUSTRIAL IOT** **9**

IoT Value Chain – IoT Platforms – Cisco, Salesforce, Azure IoT, Eclipse IoT, Thingworx, GEPredix, AWSIoT, WatsonIoT, KaaIntroductiontoIndustrialInternetofThings&Industry4.0–IIoTArchitecture–ApplicationsandChallenges.

**UNIT 5: DATA ANALYTICS &IOT CASE STUDIES** **9**

IoT Data Management–Analytics–Apache Hadoop Programming Model, JobExecution, Hadoop Cluster–Case Studies Smart Parking, Smart Irrigation Control, Air Pollution Monitoring, Forest Fire Detection, Weather Forecasting.

**TOTAL: 45 PERIODS**

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

CO1: Determine the supporting technologies for design of IoT applications.

CO2: Apply the architecture and core modules for IoT applications.

CO3: Develop IoT applications using embedded systems.

CO4: Learn the necessary of framework required for IoT application.

CO5: Apply data analytics for IoT applications.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | | | | | | | 2 | 2 | 2 | 2 | 3 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO2 | 2 | 3 | 2 | | | | | | | 3 | 2 | 3 | 3 | 2 |
| CO3 | 2 | 2 | 2 | | | | | | | 2 | 3 | 2 | 2 | 2 |
| CO4 | 2 | 3 | 3 | | | | | | | 2 | 2 | 3 | 2 | 2 |
| CO5 | 3 | 2 | 2 | | | | | | | 2 | 3 | 2 | 3 | 2 |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.ArshdeepBahga, VijayMadisetti, "InternetofThings, A Hands-on-Approach", 1stEdition,Universitiespress Pvt.Ltd.,India,2015.

2.MayurRamgir, "Internet of Things-Architecture, Implementation, and Security", 1stEdition, Pearson Education,India,2019

3.Cirani, Simone, Gianluigi Ferrari, Marco Picone, and Luca Veltri. Internet of Things: Architectures, Protocols and Standards. John Wiley & Sons, 2018.

**REFERENCE BOOKS:**

1.Raj KumarBuyya, Amir VahidDastjerdi, "Internet of Things: Principles and Paradigms",1st Edition,Elsevier,USA,2016

2.DimitriosSerpanos, MarilynWolf, "Internet-of-things (IoT) systems: architectures, algorithms, methodologies", 1stEdition, Springer,UK,2017.

3.CharlesBell, "Beginning Sensor Networks with Arduino and RaspberryPi",1stEdition, Apress Publishers,USA,2013

**WEB RESOURCES:**

Architecture of Internet of Things-https://www.geeksforgeeks.org/architecture-of-internet-of-things-iot/

https://www.amazon.in/Introduction-IoT-Sudip Misra/dp/1108959741/ref=sr_1_1?dchild=1&keywords=sudip+misra&qid=1627359928&sr=8-1

| CS606403 - **COMMUNICATION PROTOCOLS FOR IOT** | | | | | |
|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To discuss the fundamental concepts of internet protocols and standards
- To examine the protocol standards in data link and networking layers
- To simulate the different Network protocols through IoT open source tools.
- To get the knowledge of Iot based Edge Computing.
- To describe the security issues of protocols in IoT.

**UNIT 1: EVOLVING IOT STANDARDS** **9**

Overview and Approaches –IoT Ecosystem–Protocols for IoT-Structural Aspects-KeyTechnologies-Sensor Technology- RFID technology–Satellite Technology–CoAP–REST–ETSIM2M.

**UNIT 2: DATA LINK PROTOCOLS** **9**

IEEE802.15.4e-IEEE802.11ah–WirelessHART-Z-Wave-BluetoothLowEnergy-ZigbeeSmartEnergy-DASH7–HomePlug-G.9959-LTE-A –LoRaWAN–Weightless - DECT/ULE.

**UNIT 3: NETWORK LAYER PROTOCOLS** **9**

RoutingProtocols–RPL–CORPL–CARP-EncapsulationProtocols-6LoWPAN-6TiSCH-6Lo-IPv6overG.9959-IPv6overBluetooth Low Energy- Session Layer Protocols–MQTT–SMQTT–XMPP–DDS.

**UNIT 4: IOT EDGE COMPUTING** **9**

Edge Computing– Purpose and Definition – Edge Hardware Architectures – Operating System–Edge Platforms, Virtualisation – Containers –Use Cases – Ambient Computing–Synthetic Sensing.

**UNIT 5: SECURITY AND PRIVACY** **9**

Security Issues in the IoT - Security Mechanisms- Key Agreement, Distribution, and Security Bootstrapping -Key Agreement Protocols. Privacy Issues in the IoT - Role of Authorization - IoT-OAS: Delegation-based Authorization for the Internet of Things- IoT-OASApplication Scenarios.

TOTAL: 45 PERIODS

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

CO1: Describe the evolving IoT Standards

CO2: Demonstrate and visualize the data link protocols for IoT.

CO3:Evaluate the network protocols and standards for IoT.

CO4: Analyse the importance of IoT Edge devices.

CO5: Apply security mechanisms for protocol security.

CO-PO MAPPING

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | | | | | | 3 | | 3 | 2 | 3 |
| CO2 | 2 | 3 | 3 | | | | | | | 2 | | 3 | 3 | 2 |
| CO3 | 3 | 2 | 2 | | | | | | | 2 | | 2 | 3 | 2 |
| CO4 | 2 | 3 | 3 | | | | | | | 2 | | 2 | 2 | 3 |
| CO5 | 3 | 2 | 3 | | | | | | | 2 | | 2 | 3 | 2 |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Geng,Hwaiyu."Internet of Things and Data Analytics in the Cloud with Innovation and Sustainability. "The Internet of Things &Data AnalyticsHandbook,2017.

2.SimoneCirani,GianluigiFerrari,MarcoPicone,LucaVeltri InternetofThings_Architectures,ProtocolsandStandards-Wiley,2018.

3.PerryLea,"IoTandEdge Computing for Architects_ Implementing edge and IoTsystems from sensors to clouds with communication systems, analytics, and security, 2ndEdition", PacktPublishing,2020.

**REFERENCE BOOKS:**

1.JanHoller, VlasiosTsiatsis, CatherineMulligan, StefanAves and, Stamatis Karnouskos, DavidBoyle, "From Machine-to-Machine to the Internet of Things :Introduction to a New Age of Intelligence", 1stEdition,AcademicPress, 2014.

2.Vijay Madisetti, ArshdeepBahga, "Internet of Things (AHands-on Approach)", 1stEdition, VPT,2014.

3.PerryLea, "Internet of Things for Architects_ArchitectingIoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security", Packt Publishing, 2018.

**WEB RESOURCES:**

Internet of Things (IoT)- https://www.gsma.com/iot/gsma-vision-of-smart-home-report/

Communication Protocols in IoT-https://www.geeksforgeeks.org/data-link-layer-communication-protocols-in-iot/

| CS606404 - **CLOUD SERVICES FOR IOT** | | | | | | |
|---|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To comprehend the cloud architecture and its services
- To illustrate the various sensors and their cloud interfaces
- To learn the cloud platforms of IoT
- To identify various cloud services for IoT
- To familiarize the applications security issues

**UNIT 1: CLOUDPLATFORMARCHITECTUREANDSERVICES** **9**

Cloud computing and service models: Public, Private and Hybrid clouds-Infrastructure as a service (IaaS)-Platformasa service(PaaS)- Software as a service(SaaS)- Architectural design of compute and storage clouds: Layered cloud architectural development- Architectural design challenges Public cloud platforms:GAE,AWSandAzure.

**UNIT 2: PROGRAMMING IOTDEVICES FOR CLOUDINTERFACE** **9**

Basics of Sensors and actuators – examples and working principles of sensors and actuators Cloud computing andIOT – Arduino/Equivalent Microcontroller platform. IoT Communication Technologies – RFID – Bluetooth – Zigbee –Wifi–Wired Communication

**UNIT 3: CLOUDPLATFORMSFOR IOT** **9**

Think speak IoT Cloud Platform, Kaa Open Source IoT Cloud Platform, AWS IoT Cloud Platform –AWS IoT Device SDK.Arduino AWS IoT development. Raspberry Pi3-AWSIoTdevelopment.

**UNIT 4: CLOUDSERVICESFOR IOT** **9**

Service Management in Cloud Computing - Service Level Agreements (SLAs), Managing IoT Data – Looking at Data, Scalability & Cloud Services, Database& Data Storesin Cloud, LargeScaleData Processing.

**UNIT 5: SECURITYANDAPPLICATIONS** **9**

Application Safety and Service Vulnerability in Cloud Network- IoT Security and Privacy Preservation- Security and Challenges in Mobile Cloud Computing-The vital role of Fog computing in Internet of Things.

**TOTAL: 45 PERIODS**

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

CO1: Build an appropriate cloud architecture and identify the cloud services

CO2: Handle various sensors and the technologies.

CO3:Develop IoT applications using cloud platforms.

CO4: Integrate the IoT applications into the cloud services.

CO5: Access the security issues in applications and networks.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 2 | | | | | | | 2 | | | 3 | 2 |
| CO2 | 2 | 2 | 3 | | | | | | | 3 | | | 3 | 2 |
| CO3 | 3 | 2 | 3 | | | | | | | 2 | | | 2 | 2 |
| CO4 | 2 | 2 | 3 | | | | | | | 3 | | | 2 | 3 |
| CO5 | 3 | 2 | 3 | | | | | | | 2 | | | 3 | 2 |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

| |
|---|
| 1.KaiHwang, Geoffrey CFox, JackGDongarra, "Distributed and Cloud Computing, From parallel processing totheInternetofThings",MorganKaufmannPublishers,2012. |
| 2.RajKamal,"InternetofThings:ArchitectureandDesignPrinciples",McGraw-HillEducationPvt.Ltd.,2018. |
| 3.CharalamposDoukas,"BuildingInternetofThingswiththeArduino",CreateSpace, April2002. |
| **REFERENCE BOOKS:** |
| 1.Dac-Nhuong Le, Chintan Bhatt, ManiMadhukar "Security Designs for the Cloud, IoT, and Social Networking" JohnWiley& Sons (11October2019) |
| 2.HonboZhou,"TheInternetofThingsintheCloud:AMiddlewarePerspective", CRCPress,2013. |
| 3.RajkumarBuyya,ChristianVecchiola.S.ThamaraiSelvi,"MasteringCloudComputing",McGrawHillEducation,2013. |
| **WEB RESOURCES:** |
| IoT Cloud Platforms-https://devopedia.org/iot-cloud-platforms |
| Connecting IoT Devices to Cloud Service **https://embeddedcomputing.com/**application/ networking-5g/connecting-iot-devices-to-cloud-services. |

| CS606405 - **COMPUTER NETWORKS AND INTERNET PROTOCOL (NPTEL)** | | | | | |
|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To comprehend the Computer Networks architecture and its services
- To illustrate the various sensors and their cloud interfaces
- To learn the cloud platforms of IoT
- To understand the various cloud services for IoT
- To familiarize the applications security issues

| **UNIT 1: INTRODUCTION TO COMPUTER NETWORKS** | **9** |
|---|---|
| Introduction to computer networks and TCP/IP Protocols, The TCP/IP protocol suit and the TCP/IP model The concept of layering, The job of each layer, Connectionless vs. Connection oriented communication and services. TCP as CO service over CL connection and UDP as CL service over CL connection. | |
| **UNIT 2: CONVENTIONAL NETWORK MODEL** | **9** |
| Computer Networks and its fundamentals, definition of the network, its characteristics, network components and network connections. Modern network demands, packet classification, services using packet classification process, Conventional network model and modern network model based on service based on packet classification. | |
| **UNIT 3: DATA COMMUNICATION PROCESS** | **9** |
| Relation between the Bandwidth and the data rate of a channel, Data communication process and its ingredients, maximum data rate of a channel based on bandwidth of the channel and other parameters T. | |
| **UNIT 4: WIRELESS NETWORKS** | **9** |
| The EM spectrum, Radio, microwave and other types of waves. The frequencies used by different portions of the spectrum; frequency bands, characteristics of each of the portions and consequences. The relation between data communication and the frequency bands. Wired and wireless physical layers, UTP, FO cables and their use in data communication, total internal reflection principle and difference between UTP and FO cables Hidden and exposed stations problem for wireless data communication and their solution. 802.11,16 and xDSL physical layers, Wireless LAN 802.11, multiple standards and versions of 802.11, 802.11a,802.11b,802.11g,802.11n, 802.11ac, OFDM, OFDMA and Discrete multitone | |
| **UNIT 5:DATA LINK LAYER SERVICE PRIMITIVES** | **9** |
| The Data link layer duties, error handling process, introduction to CRC Error correction and other jobs of Data Link Layer, Hamming distance, hamming code, error correction vs. error detection, Convolution, Reed-Solomon, LDPC and Turbo codes Communication at data link and transport layers, need for protocols, sliding windows, Go back n and Selective repeat strategies for communication | |
| **TOTAL: 45 PERIODS** | |

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

| |
|---|
| CO1: Describe the functions of the architecture and principles of today's computer networks |
| CO2: Know the concept of Fundamentals of Computer Networks. |
| CO3: Apply channel allocation, framing, error and flow control techniques |
| CO4: Implement the protocols and their functionalities, |

CO5: Analyse the requirements for the future Internet and its impact on the computer network architecture.

CO-PO MAPPING

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 2 | | | | | | | 2 | | 2 | | |
| CO2 | 2 | 3 | 2 | | | | | | | 2 | | 3 | | |
| CO3 | 3 | 3 | 2 | | | | | | | 3 | | 2 | | |
| CO4 | 2 | 2 | 3 | | | | | | | 3 | | 3 | | |
| CO5 | 3 | 2 | 3 | | | | | | | 2 | | 2 | | |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Computer Networks by Bhushan Trivedi, Oxford University Press.

2.Data Communication and Networking by Bhushan Trivedi, Oxford University Press

3.Prof.SoumvaKanti Ghosh & Prof Sandip-Computer Networks and internet protocol, Department Computer Science Engineering,Kharagpur.

**REFERENCE BOOKS:**

1.Behrouz Forouzan, "Data Communication and Networking", McGraw Hill

2.Kurose and Ross, "Computer Networking- A Top-Down Approach",Pearson

3.W. A. Shay, "Understanding Communications and Networks",Cengage Learning.

**WEB RESOURCES:**

TCP/IP Tutorial and Technical Overview, (IBM Redbook) - Download From http://www.redbooks.ibm.com/abstracts/gg243376.html

TCP/IP Guide, Charles M. Kozierok, Available Online -http://www.tcpip guide .com Request for Comments (RFC) - IETF - http://www.ietf.org/rfc.html

| CS606406 - **PRIVACY AND SECURITY IN IOT** | | | | | |
|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To analyse the security requirements in IoT.
- To learn the crypto graphic fundamentals in IoT.
- To know the working of authentication credentials and access control.
- To familiarize with privacy protection and trust models.
- To familiarize with the various IoT Attacks.

**UNIT 1: INTRODUCTION: SECURING THE IOT** **9**

Security Requirements in IoT Architecture - Security in Enabling Technologies -Security Concerns in IoT Applications.SecurityArchitectureintheInternetofThings-SecurityRequirementsinIoT-Insufficient Authentication / Authorization– Insecure Access Control-Threats to Access Control, Privacy, and Availability - Attacks Specific to IoT. Vulnerabilities – Secrecy and Secret-Key Capacity -Authentication/Authorization for SmartDevices -Transport Encryption–Attack & Fault trees.

**UNIT 2: CRYPTOGRAPHIC FUNDAMENTALS FOR IOT** **9**

Cryptographic primitives and its role in IoT – Encryption and Decryption – Hashes – Digital Signatures – Random Number Generation – Cipher Suites – Key Management Fundamentals– Cryptographic Controls Built into IoT Messaging and Communication Protocols–IoTNodeAuthentication

**UNIT 3: IDENTITY & ACCESS MANAGEMENT SOLUTIONS FOR IOT** **9**

Identity Lifecycle – Authentication Credentials – IoT IAM infrastructure – Authorization with Publish / SubscribeSchemes–Access Control

**UNIT 4: PRIVACY PRESERVATION AND TRUST MODELS FOR IOT** **9**

Concerns in Data Dissemination – Light weight and Robust Schemes for Privacy Protection – Trust and Trust Models for IoT–Self-organizing Things-Preventing Unauthorized Access

**UNIT 5: IOT ATTACKS-CASE STUDIES** **9**

MIRAI Botnet Attack-Iran's Nuclear Facility Stuxnet Attack–Tesla Cryptojacking Attack-The TRENDnet Webcam Attack- TheJeepSUVAttack- The Owlet Wi-Fi Baby Heart Monitor Vulnerabilities- St.Jude_Hackable Cardiac Devices

**TOTAL: 45 PERIODS**

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

CO1:Identify the security requirements in IoT Architecture

CO2: Apply different crypto graphic techniques in IoT Security.

CO3:Apply different solutions in Identity and Access Management.

CO4: Familiarize the privacy preservation and trust models in IoT.

CO5: Develop solutions for different types of IoT attacks.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | | | | | | 3 | | | 2 | 2 |
| CO2 | 2 | 2 | 2 | | | | | | | 2 | | | 3 | 3 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO3 | 2 | 3 | 2 | | | | | | | 3 | | | 2 | 2 |
| CO4 | 2 | 3 | 3 | | | | | | | 3 | | | 2 | 3 |
| CO5 | 3 | 2 | 3 | | | | | | | 2 | | | 3 | 2 |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Brian Russell, Drew Van Duren, "Practical Internet of Things Security", Packt Publishing Limited, 2nd Edition, 2018.

2. ShancangLiandLiDaXu, "Securing the Internet of Things", Elsevier,2017.

3.**CunoPfister** -Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud (Make: Projects) 1st Edition, Kindle Edition.

**REFERENCE BOOKS:**

1.Raj Kumar Buyya, Amir VahidDastjerdi, "Internet of Things: Principles and Paradigms",1st Edition,Elsevier,USA,2016

2.ImitriosSerpanos, Marilyn Wolf, "Internet-of-things (IoT) systems: architectures, algorithms, methodologies", 1stEdition, Springer,UK,2017.

3.Charles Bell, "Beginning Sensor Networks with Arduino and RaspberryPi",1stEdition, Apress Publishers,USA,2013

**WEB RESOURCES:**

IoT Cloud Platforms- https://devopedia.org/iot-cloud-platforms

Connecting IoT Devices to Cloud Services **https://embeddedcomputing.com/application/** networking-5g/connecting-iot-devices-to-cloud-services.

| CS606407 - **IOT PLATFORM FOR SMART CITY PLANNING** | | | | | | |
|---|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C | |
| | | 3 | 0 | 0 | 3 | |
| **COURSE OBJECTIVES:** | | | | | | |

- To confidence in working along with Planning and civic agencies
- To work on different software/s (tools) to Simulate, analyze and authenticate the output to interpret and conclude.
- To identify the various stakeholders – both public and private.
- To involve in case studies and field visits/ field work.
- To accustom with the use of various acts and legal provisions in preparation of master plan etc.

| **UNIT 1:INTRODUCTION TO SMART CITIES** | **9** |
|---|---|
| Understanding Smart Cities Introduction to smart cities- Definition, dimensions, scope Smart Cities –Global Standards and Performance Benchmarks, Practice Code. India "100 Smart Cities" Policy and Mission. Planning for Urban Infrastructure Urban Infrastructure, Role of Planner in the provision of urban networks and services, feasibility studies for infrastructure projects, planning for major infrastructure projects, Various Infrastructure Programmes and policies by MOUD, PPP (DBOOT, BOOT, etc.) in infrastructure projects. | |
| **UNIT 2: WATER SUPPLY** | **9** |
| Water– sources of water, treatment and storage, transportation and distribution, quality, networks, distribution losses, water harvesting, recycling and reuse, norms and standards of provision, institutional arrangements, planning provisions, and management issues. Network design, Economics, distribution networks, Computer applications – Appurtenances –sensor-based Leak detection. Principles of design of water supply in buildings – House service connection. | |
| **UNIT 3: SANITATION AND SOLID WASTE** | **9** |
| Sanitation – points of generation, collection, treatment, disposal, norms and standards, grey water disposal, DEWATS, institutional arrangements, planning provisions, and management issues. storm water collection and disposal, norms and standards, institutional arrangements, planning provisions, and management issues. Municipal and other wastes –generation, typology, quantity, collection, storage, transportation, treatment, disposal, recycling and reuse, wealth from waste, norms, and standards, institutional arrangements, planning provisions, and management issues. management. | |
| **UNIT 4: ELECTRICITY & FIRE SERVICES AND RENEWABLE ENERGY** | **9** |
| Electricity – Sources of electricity, distribution networks, demand assessment, norms and standards, planning provisions, and management issues. Fire –fire hazards, vulnerable locations, methods of firefighting, norms, and standards, planning provisions, and management issues. Energy Management, energy requirement, non-conventional energy systems, management of solar energy, wind energy, tidal energy, biomass energy, energy from waste. | |
| **UNIT 5: SOCIAL INFRASTRUCTURE - EDUCATION, HEALTH, CIVIC** | **9** |
| Social Infrastructure – Education, Health, Civic Types, hierarchical distribution of facilities, Access to facilities, provision and location criteria, Norms and standards, etc. provisions for education, Tele- Health. | |

**TOTAL: 45 PERIODS**

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

CO1: Confidence in working along with Planning and civic agencies

CO2: Work on different software/s (tools) to Simulate, analyze and authenticate the output to interpret and conclude

CO3 :Know the knowledge of various stakeholders – both public and private.

CO4: Involve in case studies and field visits/ field work.

CO5: Accustom with the use of various acts and legal provisions in preparation of master plan etc

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | | | | | | 2 | | 3 | 2 | 2 |
| CO2 | 2 | 2 | 2 | | | | | | | 3 | | 2 | 2 | 3 |
| CO3 | 3 | 3 | 3 | | | | | | | 2 | | 3 | 3 | 2 |
| CO4 | 2 | 2 | 2 | | | | | | | 3 | | 2 | 2 | 3 |
| CO5 | 2 | 3 | 2 | | | | | | | 2 | | 2 | 1 | 2 |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Ben Green, 2019, The Smart Enough City: Putting Technology in Its Place to Reclaim Our Urban Future, MIT Press.

2.**CunoPfister** -Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud (Make: Projects) 1st Edition, Kindle Edition.

3.**Daniel Chew** -The Wireless Internet of Things: A Guide to the Lower Layers 1st Edition, Kindle Edition,Standards Information Network; 1st edition.

**REFERENCE BOOKS:**

1.Rashid Mehmood, et.al., 2020, Smart Infrastructure and Applications: Foundations for Smarter Cities and Societies, Springer, Switzerland.

2.Sameer Kochhar, et.al., 2008, Infrastructure and Governance, Academic Foundation, New Delhi.

3.Gathe Donald E Billings, et.al., 2009, Managing urban water supply, Dordrecht, Kulwer, Academic Press.

**WEB RESOURCES:**

Connecting IoT Devices to Cloud Services **https://embeddedcomputing.com/application/** networking-5g/connecting-iot-devices-to-cloud-services.

IoT Cloud Platforms- https://devopedia.org/iot-cloud-platforms

| CS606408 - **IOT FOR SMART GRIDS** | | | | | |
|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To impart knowledge on Smart Cities
- To Identify the emerging area of Internet of Things and Smart Grid.
- To learn the Internet of Things and Smart Grid Applications
- To Familiar with application of HAN and WAN.
- To study the prototype process of IoT

| **UNIT 1: IOT AND SMART GRID** | **9** |
|---|---|
| Internet of Things - Smart Grid- Importance of Smart Grid in Smart Cities-Integration of the Internet of Things into a Smart Grid | |
| **UNIT 2: IOT TECHNOLOGIES** | **9** |
| IoT Technologies – Communication Technologies: Home Area Network (HAN) - Neighbourhood Area Network (NAN)- Wide Area Network (WAN) - Standardization:Activities in IoT, Smart Grid and IoT aided Smart grid systems . | |
| **UNIT 3: EXISTING APPLICATIONS** | **9** |
| HAN applications: Smart Home – Electric vehicle – AMI – Integration of DERs – Power demand management- NAN applications: Smart Distribution – smart patrol – WAN applications: Transmission tower protection – monitoring of power transmission lines | |
| **UNIT 4: ARCHITECTURES FOR IOT** | **9** |
| Smart Grid Architecture Model – Three layered architecture – Four layered architecture – Cloud based architecture – Web enabled smart grid architecture – Last meter smart grid architecture | |
| **UNIT 5: PROTOTYPES FOR IOT AIDED SMART GRID SYSTEMS** | **9** |
| A Simple Prototype for Energy Efficiency- Integration of Renewable and Non Renewable energy Sources at Home- In Home Appliance Monitoring Implementation- Real time Monitoring of Medium Voltage Grid – Open issues & challenges. | |
| **TOTAL: 45 PERIODS** | |

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

CO1: Describe the concepts of Internet of Things and Smart Grid

CO2: Work on different IoT technologies and communication technologies.

CO3 : Explicate the applications of HAN, NAN and WAN

CO4: Spell out the suitable architectures for IoT aided Smart grid systems

CO5: Enumerate the suitable architecture, possible applications and existing prototypes of IoT aided smart grid system

CO-PO MAPPING

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 2 | | | | | | | 2 | | 3 | 2 | 2 |
| CO2 | 3 | 3 | 2 | | | | | | | 3 | | 2 | 2 | 3 |
| CO3 | 3 | 2 | 3 | | | | | | | 2 | | 3 | 3 | 2 |
| CO4 | 2 | 3 | 2 | | | | | | | 3 | | 2 | 2 | 3 |
| CO5 | 2 | 2 | 2 | | | | | | | 2 | | 2 | 1 | 2 |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.P. Waher, Learning Internet of Things. Packt Publishing, 2015.

2.N. Ramesh Babu, Smart Grid Systems: Modeling and Control, CRC Press,2018.

3.F. P. Sioshansi, Smart Grid: Integrating Renewable, Distributed and Efficient Energy,
Academic Press, 2011.

**REFERENCE BOOKS:**

1.A. McEwen and H. Cassimally, Designing the Internet of Things. John Wiley & Sons, 2013.

2.D. Kellmereit, The Silent Intelligence: The Internet of Things. DnD Ventures, 2013.

3.S. Borlase, Smart Grids: Advanced Technologies and Solutions, Second Edition. CRC Press, 2017.

**WEB RESOURCES:**

IntroductionTo Internet Of Things (Nptel)- https://archive.nptel.ac.in/courses/106/105/106105166/

https://www.amazon.in/dp/1032146753/ref=sr_1_3?dchild=1&keywords=sudip+misra&qid=1627359971&sr=8-3

| CS606409 - **IOT AND ITS APPLICATIONS** | | | | | | |
|---|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C | |
| | | 3 | 0 | 0 | 3 | |
| **COURSE OBJECTIVES:** | | | | | | |
| • To study the Fundamental concepts of IoT and its necessary towards society<br>• To Use of different protocols in IoT<br>• To Familiarize with IoT architectures<br>• To learn Sensors, actuators, development boards and Arduino programming<br>• To Identify the concepts of web of things and applications | | | | | | |
| | | | | | | |
| **UNIT 1: INTRODUCTION TO IOT** | | | | | | **9** |
| Introduction– Elements of an IoT ecosystem –Technology drivers– Business drivers–Trends and implications– Overview of Governance– Privacy and Security Issues | | | | | | |
| **UNIT 2: IOT PROTOCOLS** | | | | | | **9** |
| Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee–Networklayer –APSlayer – Security. | | | | | | |
| **UNIT 3: IOTARCHITECTURE** | | | | | | **9** |
| IoT Open source architecture (OIC) – OIC Architecture & Design principles– IoT Devices and deployment models–IoTivity: An OpensourceIoTstack-Overview– IoTivitystackarchitecture–Resourcemodel and Abstraction | | | | | | |
| **UNIT 4: IOT HARDWARE AND PROGRAMMING** | | | | | | **9** |
| Basics of sensors and actuators – Examples and working principles of sensors and actuators – Arduino Programming for IOT– Raspberry Pi–Reading from Sensors. Communication: Connecting microcontroller with Bluetooth and USB Connection with the Internet using Ethernet. | | | | | | |
| **UNIT 5: APPLCIATIONS AND CASE STUDY** | | | | | | **9** |
| Connected vehicles– Traffic management- Smart grids–Environmental monitoring–Smart buildings / smart homes Smart cities –Supply chain management–Industrial, agricultural and commercial management. | | | | | | |
| **TOTAL: 45 PERIODS** | | | | | | |
| **COURSE OUTCOMES:** At the end of the course, the student will be able to | | | | | | |
| CO1: Identify the fundamentals of IoT | | | | | | |
| CO2: Illustrate various IoT Protocols for establishing communication between things. | | | | | | |
| CO3 :Design and Develop IoT application using IoT architecture. | | | | | | |
| CO4: Build simple IoT Systems using Arduino and Raspberry Pi. | | | | | | |
| CO5: Create IoT solutions using sensors, actuators and Devices | | | | | | |
| | | | | | | |
| **CO-PO MAPPING** | | | | | | |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | | | | | | | 2 | | 2 | 3 | 2 |
| CO2 | 2 | 2 | 2 | | | | | | | 2 | | 3 | 2 | 3 |
| CO3 | 2 | 3 | 3 | | | | | | | 2 | | 2 | 3 | 2 |
| CO4 | 2 | 3 | 2 | | | | | | | 3 | | 2 | 2 | 3 |
| CO5 | 2 | 2 | 2 | | | | | | | 2 | | 2 | 1 | 2 |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Introduction of IoT- Prof.SudipMisra ,Department of Computer Science and Engineering,kharagpur,Published 2021,in India.

2.**CunoPfister** -Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud (Make: Projects) 1st Edition, Kindle Edition.

3.**Daniel Chew** -The Wireless Internet of Things: A Guide to the Lower Layers 1st Edition, Kindle Edition,Standards Information Network; 1st edition.

**REFERENCE BOOKS:**

1.ArshdeepBahga, Vijay Madisetti, "Internet of Things–A hands-on approach", Universities Press, 2015.

2.David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press, 2010.

3.Dieter Uckelmann, Mark Harrison, Michahelles, Florian(Eds), "Architecting the Internet of Things", Springer,2011.

**WEB RESOURCES:**

IntroductionTo Internet Of Things (Nptel)- https://archive.nptel.ac.in/courses/106/105/106105166/

https://www.amazon.in/dp/1032146753/ref=sr_1_3?dchild=1&keywords=sudip+misra&qid=1627359971&sr=8-3

| CS606410 - **INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS (NPTEL)** | | | | | |
|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To study the Fundamental concepts of IoT and its necessary towards society
- To Use of different protocols in IoT
- To Familiarize with IoT architectures
- To learn Sensors, actuators, development boards and Arduino programming
- To Identify the concepts of web of things and applications

| **UNIT 1: INTRODUCTION OF COMMUNICATION AND NETWORK** | **9** |
|---|---|
| Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II , Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories. | |
| **UNIT 2: BIG DATA ANALYSIS** | **9** |
| Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis.Cyber security in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems. | |
| **UNIT 3: INDUSTRIAL IOT** | **9** |
| IoT-Introduction, Industrial IoT: Business Model and Reference Architecture : IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II.IndustrialIoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-PartIndustrial IoT-Layers: IIoT Communication-Part II, Part III, IIoT Networking-Part I, Part II, Part III.IndustrialIoT: Big Data Analytics and Software Defined Networks: IIoT Analytics | |
| **UNIT 4: INTRODUCTION, MACHINE LEARNING AND DATA SCIENCE** | **9** |
| Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop.IndustrialIoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II. | |
| **UNIT 5: IoT- APPLICATION DOMAINS** | **9** |
| Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains: Factories and Assembly Line, Food industry. Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management. Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies | |
| **TOTAL: 45 PERIODS** | |

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

| |
|---|
| CO1: Apply the network concepts of communication |
| CO2: Identify the Big Data Analysis and basics of IoT in Industries . |
| CO3 :Implement the IoT Application in Industries. |

CO4: Analyse the Machine learning and data science.

CO5: Design and Develop IoT application using IoT architecture.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 2 | | | | | | | 3 | | 3 | 2 | 2 |
| CO2 | 3 | 2 | 3 | | | | | | | 2 | | 2 | 3 | 2 |
| CO3 | 2 | 2 | 3 | | | | | | | 2 | | 2 | 3 | 2 |
| CO4 | 2 | 3 | 2 | | | | | | | 3 | | 2 | 2 | 3 |
| CO5 | 2 | 2 | 2 | | | | | | | 2 | | 2 | 1 | 2 |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.**Daniel Chew** -The Wireless Internet of Things: A Guide to the Lower Layers 1st Edition,
Kindle Edition,Standards Information Network; 1st edition.

2.Introduction of IoT- Prof.SudipMisra ,Department of Computer Science and Engineering,kharagpur,Published 2021,in India.

3.**CunoPfister** -Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud (Make: Projects) 1st Edition, Kindle Edition.

**REFERENCE BOOKS:**

1.S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press.

2.S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.

3.DimitriosSerpanos, MarilynWolf, "Internet-of-things (IoT) systems: architectures, algorithms, methodologies", 1stEdition, Springer,UK,2017.

**WEB RESOURCES:**

Introduction To Internet Of Things (Nptel)-https://archive.nptel.ac.in/courses/106/105/106105166/

https://www.amazon.in/dp/1032146753/ref=sr_1_3?dchild=1&keywords=sudip+misra&qid=1627359971&sr=8-3

# VERTICAL V
# BLOCK CHAIN

CS606501 - **FOUNDATIONS OF CRYPTOGRAPHY (NPTEL)**

| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- Togain the knowledge about Symmetric-key Encryption
- To develop the knowledge in Theoretical & Practical Constructions of Block Ciphers.
- To learn about MAC &Generic Attacks on Hash Functions,
- To Compose CPA-secure Cipher with a Secure MAC& Cyclic Groups
- To analyse Public-key Encryption &Zero-Knowledge Protocols

**UNIT 1:SYMMETRIC-KEY ENCRYPTION&STREAM CIPHERS** **9**

Introduction -Symmetric-key Encryption -Historical Ciphers and their Cryptanalysis - Perfect Security - Limitations of Perfect Security – Introduction to Computational Security - Semantic Security -Pseudo-random Generators (PRGs) - Operations on Pseudorandom Generators - Stream Ciphers - Provably-secure Instantiation of PRG - Practical Instantiations of PRG - CPA-security - Pseudo-random Functions (PRFs) - CPA-secure Encryption from PRF

**UNIT 2: BLOCK CIPHERS&MESSAGE AUTHENTICATION** **9**

Modes of Operations of Block Ciphers Part I - Modes of Operations of Block Ciphers Part II - Theoretical Constructions of Block Ciphers - Practical Constructions of Block Ciphers: Part I - Practical Constructions of Block Ciphers: Part II - From Passive to Active Adversary - Message Integrity and Authentication - Message Authentication for Long Messages : Part I - Message Authentication for Long Messages : Part II

**UNIT 3: INFORMATION-THEORETIC MACS&HASH FUNCTIONS** **9**

Information-theoretic MACs : Part I - Information-theoretic MACs : Part II - Cryptographic Hash Functions: Part I - Cryptographic Hash Functions: Part II - Message Authentication Using Hash Functions - Generic Attacks on Hash Functions and Additional Applications of Hash Functions - Random Oracle Model: Part I - Random Oracle Model: Part II - Authenticated Encryption

**UNIT 4: COMPOSING CPA, CYCLIC GROUPS** **9**

Composing CPA-secure Cipher with a Secure MAC: Part I - Composing CPA-secure Cipher with a Secure MAC: Part II - Key-Exchange Protocols: Part I - Key-Exchange Protocols: Part II - Cyclic groups - Cryptographic Hardness Assumptions in the Cyclic Groups - Candidate Cyclic Groups for Cryptographic Purposes: Part I - Candidate Cyclic Groups for Cryptographic Purposes: Part II - Cryptographic Applications of the Discrete Log Assumption

**UNIT 5: PUBLIC-KEY ENCRYPTION&ZERO-KNOWLEDGE PROTOCOLS** **9**

Public-key Encryption - El Gamal Public-key Encryption Scheme - RSA Assumption - RSA Public-key Cryptosystem - Hybrid Public-key Cryptosystem - CCA-Secure Public-key Ciphers - CCA-Secure Public-key Ciphers Based on Diffie-Hellman Problems - CCA-Secure Public-key Ciphers Based on RSA Assumption - Digital Signatures - RSA Signatures - Identification Schemes - Schnorr Signature Scheme and TLS/SSL - Number Theory - Secret Sharing - Zero-Knowledge Protocols: Part I - Zero-Knowledge Protocols: Part II

**TOTAL: 45 PERIODS**

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

CO1: Gain the knowledge about Symmetric-key Encryption

CO2:Develop the knowledge in Theoretical & Practical Constructions of Block Ciphers

CO3: Analyze security properties MAC &Generic Attacks on Hash Functions

CO4:Compose CPA-secure Cipher with a Secure MAC & Cyclic Groups

CO5: Analyse Public-key Encryption &Zero-Knowledge Protocols

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | | | | | | 2 | | 2 | | |
| CO2 | 2 | 3 | 2 | | | | | | | 2 | | 2 | | |
| CO3 | 2 | 3 | 2 | | | | | | | 2 | | 2 | | |
| CO4 | 2 | 2 | 3 | | | | | | | 2 | | 2 | | |
| CO5 | 3 | 2 | 2 | | | | | | | 2 | | 2 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Foundations of Cryptography – Prof. Ashish Choudhury, CSE,IIIT - Bangalore

2.Understanding Cryptography - A Textbook for Students and Practitioners
By Christof Paar, Jan Pelzl - 2014

3.Applied Cryptography - Protocols, Algorithms and Source Code in CBy Bruce Schneier · 2017

**REFERENCE BOOKS:**

1.Break the Code - Cryptography for BeginnersBy Bud Johnson · 2013

2.Practical CryptographyBy Niels Ferguson, Bruce Schneier · 2003

3.Serious Cryptography - A Practical Introduction to Modern Encryption By Jean-Philippe Aumasson · 2017

**WEB RESOURCES:**

1.https://archive.nptel.ac.in/courses/106/106/106106221/

2.https://inst.eecs.berkeley.edu//~cs161/sp11/

| CS606502 - **BLOCK CHAIN AND ITS APPLICATIONS (NPTEL)** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To provide conceptual understanding of how Blockchain technology can be used to innovate and improve business processes& deploy Decentralized Application
- To gain the knowledge about the various Blockchain elements&Permissionless Model
- To learnEthereum & Distributed Consensus
- To describe Hyperledger Fabric
- To develop Blockchain Interoperability & Blockchain Security

| | |
|---|---|
| **UNIT 1:BLOCKCHAIN TECHNOLOGY & CRYPTOGRAPHIC PRIMITIVES** | **9** |
| The Model of Decentralization - What is Blockchain- BasicCryptographic Primitives I - II – III – IV -V,Distributed Systems for Decentralization - The Evolution of Cryptocurrencies - Open Consensus and Bitcoin. | |
| **UNIT 2: BLOCKCHAIN ELEMENTS** | **9** |
| Bitcoin Mining and Beyond - Smart Contracts and the Permissioned Models of Blockchain - Blockchain Elements – I – II – III – IV –V, Permissionless Model and Open Consensus - Nakamoto Consensus (Proof of Work) - Limitations of PoW: Forking and Security | |
| **UNIT 3: ETHEREUM & DISTRIBUTED CONSENSUS** | **9** |
| Beyond PoW - Ethereum 1-2-3-4 - Consensus for Permissioned Models - State Machine Replication as Distributed Consensus – Paxos - Byzantine Faults - Byzantine Agreement Protocols | |
| **UNIT 4: HYPERLEDGER FABRIC** | **9** |
| Safety and Liveness of PBFT - Enterprise Blockchains – Hyperledger Fabric 1-2-3-4 - Consensus Scalability - Bitcoin-NG - Collective Signing | |
| **UNIT 5: BLOCKCHAIN INTEROPERABILITY&SECURITY** | **9** |
| Blockchain Interoperability – I – II –III - Hyperledger Indy I – II - Hyperledger Aries - Blockchain Security – I –II – III - Use Cases - A Potential Use Case From a Critics Perspective- Blockchain in Financial Services - Public Sector Use Cases - Blockchain for Decentralized Marketplace | |
| **TOTAL: 45 PERIODS** | |

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

CO1: implement Block chain technology & deploy Decentralized Application

CO2: knowledge about the various Blockchain elements &Permissionless Model

CO3: analyze block chain based solutions and write smart contract using Ethereum Framework

CO4: describe the knowledge about Hyperledger Fabric

CO5: develop Blockchain Interoperability &implement Blockchain Security

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 2 | | | | | | | 2 | | 2 | | |
| CO2 | 2 | 2 | 2 | | | | | | | 2 | | 2 | | |
| CO3 | 3 | 2 | 2 | | | | | | | 2 | | 2 | | |
| CO4 | 3 | 2 | 2 | | | | | | | 3 | | 3 | | |
| CO5 | 2 | 2 | 3 | | | | | | | 2 | | 3 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, 3rd Edition, Imran Bashir, Packt Publishing, 2020,

2.Bloomsbury A Practical Guide to Blockchain and Its Applications by PARIKSHIT JAIN Edition 2019

3.Blockchain Technology and Applications : A systematic and Practical approach Kindle Edition by Amit Dua (Author)

**REFERENCE BOOKS:**

1.Blockchain and its applications by PROF. SANDIP CHAKRABORTY Department of Computer Science and Engineering IIT Kharagpur PROF. SHAMIK SURAL Department of Computer Science and Engineering IIT Kharagpur

2.Advanced Applications of Blockchain Technology (Studies in Big Data Book 60) 1st ed. 2020 Edition, Kindle Editionby **Shiho Kim** (Editor), **Ganesh Chandra Deka** (Editor)

3.Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications (Grayscale Indian Edition) (Paperback, Lorne Lantz, Daniel Cawrey)

**WEB RESOURCES:**

1.https://www.packtpub.com/product/mastering-blockchain-third-edition/9781839213199

2.https://archive.nptel.ac.in/courses/106/105/106105235/

3.https://www.hyperledger.org/use/tutorials

4.https://ethereum.org/en/developers

CS606503 - **BLOCK CHAIN TECHNOLOGIES**

| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To learn the various cryptography primitives used in block chain.
- To study the design principles of block chain.
- To describe the various consensus algorithms.
- To implement the block chain in networking.
- To learn the enhancements of block chain technologies

**UNIT 1: CRYPTOGRAPHY IN BLOCKCHAIN** **9**

Block chain Definitions – Block chain versus Databases – History – Motivation – Characteristics – Types – Overview -Hashing in Block chain – Linking blocks in block chain – Linking blocks using SHA256 – Block structure – Block chain functionality – Creating Block chain – Byzantine failure problem in block chain – Digital signatures in block chain –Block chain wallets

**UNIT 2: BLOCKCHAIN DESIGN PRINCIPLES** **9**

Networked Integrity – Distributed Power-Value as Incentive – Security – Privacy – Rights Preserved – Inclusion –Centralized Registries versus Distributed Ledgers – Public versus Private Ledgers – Transparency as a Strategic Risk –Transparency as a Strategic Asset-Zero Knowledge Proofs

**UNIT 3: CONSENSUS ALGORITHMS** **9**

Proof of Work – Pure Stake Based Consensus – Proof of Stake - Leased Proof of Stake – Delegated Proof of Stake –Hybrid Form of PoS and PoW – Practical Byzantine Fault Tolerance – Ripple –Tendermint – Proof of Elapsed Time –ProofofActivity–ProofofBurn– Hyperledger Fabric

**UNIT 4: NETWORKING IN BLOCKCHAIN** **9**

Peer – to –peer Networking – Network Discovery – Block Synchronization – Building a simple Blockchain in P2PNetwork – Validating new Block – Selecting Longest chain – Block Exchange between Peers – Application Interfaces-Blockchain Networks–Testnet– Regtest –Blockchain in 5G–Blockchain in Social Networking–Blockchain for IoT

**UNIT 5: BLOCKCHAIN OPTIMIZATIONS AND ENHANCEMENTS** **9**

Blockchain Optimizations – Transaction Exchange – Off-chain Transactions – Block size improvements – Blockchain enhancements – Sharding – Evolution of consensus algorithm – Proof of Stake – Proof of Activity – Byzantine Fault Tolerance Consensus Models – Proof of Elapsed Time – Cross-chain Protocol – Privacy Enhancement – Blockchain Security – Transaction Security Model–Decentralized Security Model–Attacks on Blockchain

**TOTAL: 45 PERIODS**

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

CO1:Implement the required cryptography primitives for block chain systems.

CO2: Work with various block chain design principles.

CO3: Implement with various consensus algorithms.

CO4: Equip networks with the various block chain techniques.

CO5: Work with block chain optimization techniques.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | | | | | | 2 | | 2 | | |
| CO2 | 2 | 2 | 2 | | | | | | | 2 | | 2 | | |
| CO3 | 3 | 2 | 2 | | | | | | | 3 | | 2 | | |
| CO4 | 2 | 2 | 2 | | | | | | | 2 | | 3 | | |
| CO5 | 3 | 2 | 2 | | | | | | | 2 | | 3 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.KoshikRaj, "Foundations of Blockchain", Packt Publishers, 2019

2.S.Shukla, M.Dhawan, S.Sharma and S.Venkatesan, "Blockchain Technology: Crypto currency and Applications", Oxford UniversityPress, 2019.

3.Josh Thompson, "Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming", Create Space Independent Publishing Platform, 2017

**REFERENCE BOOKS:**

1.AndreasM.Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", OreillyMedia, 1stEdition, 2014.

2.Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller,and Steven Goldfeder. "Bitcoin and cryptocurrency technologies: a comprehensive introduction", Princeton University Press, 2016.

3.Blockchain Technology: Exploring Opportunities, Challenges, and Applications
**Publisher: CRC Press ,Authors:** Sonali Vyas, Vinod Kumar Shukla, Shaurya Gupta, Ajay Prasad

4.Blockchain and Web3: Building the Cryptocurrency, Privacy, and Security Foundations of the Metaverse , Publisher: Wiley , Author: Winston Ma and Ken Huang

**WEB RESOURCES:**

1.https://www.ibm.com/topics/blockchain#:~:text=first%20blockchain%20application-,Blockchain%20overview,patents%2C%20copyrights%2C%20branding).

2.https://www.edx.org/course/introduction-to-hyperledger-blockchain-technologie

| CS606504 - **BLOCKCHAIN ARCHITECTURE DESIGN AND USE CASES (NPTEL)** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To learn the various cryptography primitives used in Blockchain.
- To study the Hyperledger Fabric of Blockchain.
- To describe the various use cases of Blockchain.
- To study the Blockchain security .
- To learn the research aspects of block chain in AI and Bigdata

| **UNIT 1:BLOCKCHAIN AND CRYPTO PRIMITIVES** | **9** |
|---|---|
| Introduction to Blockchain - Crypto Primitives - Distributed Consensus - Consensus in Bitcoin – I (The Basics, PoW and Beyond, The Miners) - Permissioned Blockchain : Basics, Consensus , RAFT Consensus, Byzantine General Problem, Practical Byzantine Fault Tolerance | |
| **UNIT 2: HYPERLEDGER FABRIC** | **9** |
| Hyperledger Fabric - Blockchain for Enterprise – Overview -Blockchain Components and Concepts - Hyperledger Fabric – Transaction Flow - Hyperledger Fabric Details - Fabric – Membership and Identity Management - Hyperledger Fabric Network Setup - Fabric Demo: Fabric Demoon IBM Blockchain Cloud Fabric Demo, deploy from scratch , Hyperledger Composer – Application Development , Hyperledger Composer – Network Administration | |
| **UNIT 3: USE CASES** | **9** |
| Block chain Use Cases - Financial Service - Payments and Secure Trading, Compliance and Mortgage, Financial Trade ; Revolutionizing Global Trade , Blockchain in Supply Chain - Blockchain in Other Industries | |
| **UNIT 4: BLOCK CHAIN SECURITY** | **9** |
| Blockchain in Government : Advantages, Use Cases, Digital Identity - Hyperledger Indy, Tax Payments and Land Registry Records -Blockchain Security : Overview, Membership and Access control in Fabric,Privacy in Fabric - Blockchain Security: Fabric SideDB | |
| **UNIT 5: RESEARCH ASPECTS** | **9** |
| Research Aspects : Consensus Scalability, Bitcoin-NG, Collective Signing, Byzcoin ; Research Aspects : Algorand,Cross Fault Tolerance, Secured Multi-Party Computation ; Blockchain for Science : Blockchain for Big Data,Blockchain and AI ; Comparing Ecosystems – Ethereum– Ethereum development tools and Quorum – Corda Part 1 – Corda Part 2 | |
| **TOTAL: 45 PERIODS** | |

| **COURSE OUTCOMES:** At the end of the course, the student will be able to |
|---|
| CO1: Identify the various cryptography primitives used in Blockchain. |
| CO2: Summarize the Hyperledger Fabric of Blockchain. |
| CO3: Implement the various use cases of Blockchain.. |
| CO4: Analyze the Blockchain security . |
| CO5: Describe research aspects of Blockchain in AI and Bigdata |
| **CO-PO MAPPING** |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | | | | | | 2 | | 2 | | |
| CO2 | 2 | 2 | 2 | | | | | | | 2 | | 2 | | |
| CO3 | 3 | 2 | 2 | | | | | | | 3 | | 2 | | |
| CO4 | 2 | 2 | 2 | | | | | | | 2 | | 3 | | |
| CO5 | 3 | 2 | 2 | | | | | | | 2 | | 3 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos - Blockchain by Melanie Swa, O'Reilly

2.Blockchain state-of-the-art: architecture, use cases, consensus, challenges and opportunities, Author:Bela Shrimali · Hiren B. Patel

3.Hyperledger Fabric - Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits

**REFERENCE BOOKS:**

1.The Basics of Bitcoin and Blockchain 2021: Basics of Cryptocurrency for the Beginners by **Spazi Liberi** (Author)

2.Architecture for Blockchain Applications By Xiwei Xu, Ingo Weber, Mark Staples · 2019

3.The Blockchain and the New Architecture of Trust by Kevin Werbach

**WEB RESOURCES:**

1.https://www.udemy.com/course/understanding-blockchain-technology/

2.https://onlinecourses.nptel.ac.in/noc19_cs63/preview

| CS606505 - **BLOCK CHAIN PLATFORMS** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To describe the various primitives used in block chain.
- To implement using Ethereum Platform.
- To analysis the various modules in Hyper ledger framework.
- To develop using Hyper ledger Platform
- To learn about different Block chain Platforms.

| **UNIT 1:INTRODUCTION** | **9** |
|---|---|
| Decentralized applications-Dapp-Good and bad Dapps-Understanding the blockchain-A deeper look at decentralized applications-Ethereum's history and governance-Connecting to Ethereum through the wallet-Smart contracts: The brain of Dapps-Connecting to Ethereum with geth-Managing accounts with geth | |
| **UNIT 2: ETHEREUM** | **9** |
| Managing smart contracts with Web3.js-Revisiting deployment through geth's interactive console- Interacting with SimpleCoin through geth's console-Simplifying command-based deployment with Node.js-Deploying on a private network-Making development more efficient by deploying on mock networks-Smoother interaction with SimpleCoin through a web UI-The Ethereum ecosystem-The core components -Decentralized address resolution with ENSDecentralized content storage-Accessing external data through oracles-Dapp frameworks and IDEs | |
| **UNIT 3: HYPER LEDGER FABRIC FRAMEWORK** | **9** |
| Exploring Hyperledger Fabric- Hyperledger frameworks, tools, and building blocks-Hyperledger frameworks Hyperledger tools-The building blocks of blockchain solutions-Hyperledger Fabric component design-the Journey of a sample transaction-Hyperledger Fabric explored-Understanding governance in business networks powered by blockchain | |
| **UNIT 4: IMPLEMENTATION IN HYPERLEDGER** | **9** |
| The Hyperledger Family-Prerequisites and Setting up a Development Environment – Developing First Business Network and Deploying it -Define your Business Network - Secure your API using Passport and Enable Multi-Use Case Study and Implementation | |
| **UNIT 5: DIFFERENT BLOCK CHAIN PLATFORMS** | **9** |
| Multichain-Features-Mechanisms-Deployment-R3 Corda-Features-Model-Consensus Mechanism –Use cases- Ripple Technology- Transaction- IOTA-Consensus Mechanism-Implementation-Setup-Real World Implementation | |
| TOTAL: 45 PERIODS | |

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

| |
|---|
| CO1: Implement the required cryptography primitives for block chain systems |
| CO2: Develop and Deploy using Ethereum Platform. |
| CO3: Work with various techniques in Hyper ledger framework. |
| CO4: Develop and Deploy using Hyper ledger Platform |
| CO5: Work with alternate Block chain Platforms |
| **CO-PO MAPPING** |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | | | | | | | 2 | | 2 | | |
| CO2 | 1 | 2 | 2 | | | | | | | 3 | | 2 | | |
| CO3 | 2 | 2 | 3 | | | | | | | 2 | | 2 | | |
| CO4 | 2 | 3 | 2 | | | | | | | 3 | | 2 | | |
| CO5 | 2 | 2 | 3 | | | | | | | 2 | | 2 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.RobertoInfante, " Building EthereumDapps ", Manning Publications, March 2019, ISBN: 9781617295157

2.Petr Novotny, Nitin Gaur, Luc Desrosiers, Salman A. Baset ,"Blockchain Development with Hyperledger", Packt Publishing, March 2019

3.NiazChowdhury, "Inside Blockchain, Bitcoin, and Cryptocurrencies", CRC press, Taylor & Francis,2020.

4.Ernesto Lee, Sudip Ghosh, "Enterprise Blockchain Development: With Hyperledger Fabric and Composer" , ConsultantsNetwork,2018

**REFERENCE BOOKS:**

1.Josh Thompson, "Blockchain: The Blockchain for Beginnings Guide to Blockchain Technology and Leveraging Blockchain Programming", Create Space Independent Publishing Platform, 2017.

2.Andreas M. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", Oreilly Media, 1st Edition, 2014.

3.Austin Grice, Eric Everson Mendes Marins, Garrett Lee Woodworth, Juliana Medeiros Destro, Rahul Gupta, VasfiGucer , "Implementation Guide for IBM Blockchain Platform for Multicloud", IBM Redbooks,2019.

**WEB RESOURCES:**

1.https://www.youtube.com/watch?v=Xm5qx2ZG7Z4

2.https://ethereum.org/en/what-is-ethereum/

CS606506 - **BLOCK CHAIN FORENSICS**

| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To learn about security and privacy in Bitcoin and Block chain
- To propose Block chain based security mechanism for different applications
- To understand the importance of bitcoin forensics
- To build Block chain-based apps and PKI solutions
- To understand challenges and the future of cyber security and Blockchain

**UNIT 1:BLOCKCHAIN ON THE CIA SECURITY TRIAD** **9**

CIA security triad- Blockchain on confidentiality-Blockchain on integrity-Blockchain on availability-Deploying PKI-Based Identity with Blockchain-Two-FactorAuthenticationwithBlockchain.

**UNIT 2: BLOCKCHAIN BASED SECURITY MECHANISMS** **9**

Domain Name System- Understanding DNS components- DNS structure and hierarchy-DNS topology for large enterprise-Blockchain-based DNS solution- Blockchain-Based DDoS Protection.

**UNIT 3: BITCOIN FORENSICS** **9**

Crypto currency artifacts and investigation–Bitcoin crimes–Crypto currency investigation challenges-CasestudiesTracking bitcoin transactions-Numisight bitcoin explorer

**UNIT 4: SECURITYAND PRIVACY IN BITCOIN** 9

SecurityofconfirmedtransactionsSecurityofZero-confirmationTransactionsBitcoinForks-Userprivacy-Networklayer attacks-Enhancing privacy in bitcoin

**UNIT 5:BLOCKCHAIN AND CYBER SECURITY- CHALLENGES AND FUTURE** **9**

Decision path for Blockchain – Checklist–Challenges- Future of cyber security with Blockchain.

**TOTAL: 45 PERIODS**

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

CO1: Understand the security and privacy in Bitcoin and Blockchain

CO2: Develop Block chain-based security mechanism for different applications

CO3: Comprehend the need for bitcoin forensics

CO4:Summarize the security and privacy issues in bit coin

CO5: Realize the challenges and the potential of block chain in the field of cyber security.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | | | | | | | 2 | | 2 | | |
| CO2 | 2 | 2 | 2 | | | | | | | 3 | | 2 | | |
| CO3 | 2 | 2 | 2 | | | | | | | 2 | | 2 | | |
| CO4 | 2 | 2 | 1 | | | | | | | 3 | | 2 | | |
| CO5 | 2 | 2 | 2 | | | | | | | 2 | | 2 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Rajneesh Gupta, Hands-On Cyber security with Blockchain", PacktPublishing,2018

| |
|---|
| 2.Niranjan Reddy, "Practical Cyber Forensics: An Incident-Based Approach to Forensic Investigations", Apress,2019 |
| 3.TianaLaurence, "Blockchain For Dummies", Dummies,2017. |
| **REFERENCE BOOKS:** |
| 1.GhassanKarame, Elli And roulaki, "Bitcoin and Blockchain Security", Artech,2017 |
| 2.HarishGarg, "Hands-On Bitcoin Programming with Python", Packt Publishing, 2018 |
| 3.MakotoYano, ChrisDai, Kenichi Masuda, Yoshio Kishimoto, "Block chain And CryptCurrency: Building A High Quality Market place For Crypt Data", Springer2020. |
| **WEB RESOURCES:** |
| 1.https://www.youtube.com/watch?v=mBW7djo_fg8 |
| 2.https://www.youtube.com/watch?v=Ylp4qexTwi4 |

| CS606507 - **ROBOT MANIPULATOR CONTROL** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- State space modelling of robot manipulator arm.
- Robot manipulator dynamics.
- Computed torque control.
- Robust control of robot manipulator
- Adaptive robust control of robot manipulator

| **UNIT 1:INTRODUCTION** | **9** |
|---|---|
| Introduction – structure of robot manipulator - transfer function approach - State variable representation – Linear state variable system – double integrator system, Non-linear state variable representation of robot manipulator, Equilibrium points and Lyapunov stability theorem. | |
| **UNIT 2: ROBOT MANIPULATOR DYNAMICS AND STABILITY** | **9** |
| Lagrange-Euler Dynamics – Force, Inertia, and Energy - Lagrange's Equations of Motion, Manipulator Dynamics -Dynamics of two-link planar and planar elbow arm – manipulator arm kinematic energy – manipulator arm potential energy –Structure and properties of robot equation | |
| **UNIT 3: COMPUTED-TORQUE CONTROL OF ROBOT MANIPULATOR** | **9** |
| Path Generation – Converting Cartesian trajectories to Joint space trajectories – polynomial path interpolation –Linear function with parabolic blends – minimum time trajectories, Independent Joint Control – feedback control –decentralised feedback compensation, Computed Torque Control – PD Outer Loop Design- PID Outer Loop Design -PD-Plus-Gravity Controller. | |
| **UNIT 4: ROBUST CONTROL OF ROBOT MANIPULATOR** | **9** |
| Introduction, Feedback- Linearization Controllers– Lyapunov design–Input Output design, Dynamic Controllers– Non-linear Controllers- Direct passive controllers– variable structure controllers–saturation type controllers. | |
| **UNIT 5: ADAPTIVE CONTROL** | **9** |
| Introduction to Adaptive Control, Computed Torque approach Approximate computed torque controller- Adaptive computed torque controller, Adaptive Control by an Inertia-Related Approach - Adaptive Inertia- Related Controller, Robot Controllers with Reduced on-line Computation-Desired Compensation Adaptation Law- Repetitive Control Law– Adaptive Robust Control–Compensation for Actuator Dynamics. | |
| **TOTAL: 45 PERIODS** | |

| **COURSE OUTCOMES:** At the end of the course, the student will be able to |
|---|
| CO1: Analyze the state space representation of the robot manipulator |
| CO2: Identify the Derive the Robot Dynamical Equations |
| CO3: Describe computed torque control of Robotic Systems |
| CO4: Designate and Compare robust and adaptive control of robot manipulator arm. |
| CO5: Describe adaptive robust control of robot manipulator arm. |
| **CO-PO MAPPING** |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | | | | | | | 2 | | 2 | | |
| CO2 | 2 | 3 | 2 | | | | | | | 2 | | 3 | | |
| CO3 | 3 | 2 | 2 | | | | | | | 3 | | 2 | | |
| CO4 | 2 | 2 | 3 | | | | | | | 2 | | 2 | | |
| CO5 | 2 | 2 | 2 | | | | | | | 2 | | 3 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.FrankLLewis, DarrenM.Dawson, ChaoukiT.Abdallah, "Robot Manipulator Control–Theory and Practice", Marcel DekkerInc.,2004

2.Lorenzo Sciavicco and BrunoSiciliano, "Modelling and Control of Robot Manipulators" Springer, Second edition, 2012

3.MosheShoham "A Textbook of Robotics–Structure Control and Operation" EshedRobotec,1984

**REFERENCE BOOKS:**

1.RezaN.Jazar, "Theory of Applied Robotics-Kinematics, Dynamics, and Control", Springer International, 2007

2.Model-Based Control of a Robot Manipulator (Artificial Intelligence)by Chae H. An , Christopher G. Atkeson, et al. | Apr 7, 1988

3.Fundamentals for Control of Robotic Manipulatorsby Antti J. Koivo | Jun 14, 1989

**WEB RESOURCES:**

1.https://www.youtube.com/watch?v=5DnKot3mMSc

2.https://www.youtube.com/watch?v=zf223NAOfcA

3.https://www.youtube.com/watch?v=4hQfnBtQJEA

| CS606508 - **COMPUTER VISION WITH OPEN CV** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Program Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To gain the knowledge of the Open CV methods to apply the basic operations on images
- To learn about histogram and binary vision
- To study about geometric transformations and edge detection
- To analyze various features and recognition techniques
- To implement the video tracking and panoramas

| **UNIT 1:OPENCV AND BASIC OPERATIONS ON IMAGES** | **9** |
|---|---|
| History of OpenCV - Built-in Modules - Setting up OpenCV on Your Computer - Stereo Matching - Homography Estimation in Video - Circle and Line Detection - Image Segmentation - Bounding Box and Circle - Image Inpainting -Displaying Images from Disk in a Window - The cv::Mat Structure - Converting Between Color-spaces - GUI Track-Bars and Callback Functions- ROIs: Cropping a Rectangular Portion out of an Image- Accessing Individual Pixels of an Image -Videos | |
| **UNIT 2: IMAGES, HISTOGRAMS, BINARY VISION** | **9** |
| Simple pinhole camera model – Sampling – Quantisation – Colour images – Noise – Smoothing –1D and 3D histograms- Histogram / Image Equalisation - Histogram Comparison- Back- projection-k-means Clustering – Thresholding- Threshold Detection Methods- Variations on Thresholding-Mathematical Morphology- Connectivity | |
| **UNIT 3: EDGES AND GEOMETRIC TRANSFORMATIONS** | **9** |
| Problem Specification and Algorithm - Affine Transformations - Perspective Transformations - Specification of MoreComplex Transformations – Interpolation - Modelling and Removing Distortion from Cameras - Edge Detection -ContourSegmentation-Hough Transform | |
| **UNIT 4: FEATURES AND RECOGNITION** | **9** |
| Moravec Corner Detection - Harris Corner Detection - FAST Corner Detection – SIFT - Other Detectors - Template Matching - Chamfer Matching - Statistical Pattern Recognition - Cascade of Haar Classifiers - Other Recognition Techniques–Performance | |
| **UNIT 5: VIDEO AND PANORAMAS** | **9** |
| Moving Object Detection– Tracking- Video Datasets and Formats-Metrics for Assessing Video Tracking Performance– Affine Transformations- Perspective Transformations- Image panorama | |
| **TOTAL: 45 PERIODS** | |

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

| |
|---|
| CO1: Apply Open CV image processing basic operations |
| CO2: Find the histogram and apply thresholding |
| CO3: Do edge detection and apply geometric transformations in images |
| CO4: Extract various features from images |
| CO5: Create image panorama and track videos |

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | | | | | | | 2 | | 3 | | |
| CO2 | 2 | 2 | 2 | | | | | | | 2 | | 2 | | |
| CO3 | 2 | 2 | 2 | | | | | | | 2 | | 3 | | |
| CO4 | 2 | 2 | 3 | | | | | | | 2 | | 2 | | |
| CO5 | 2 | 2 | 2 | | | | | | | 2 | | 3 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**


1. KennethDawson-Howe,"APracticalIntroductiontoComputerVisionwithOpenCV",Wiley,2014

2. SamarthBrahmbhatt,"PracticalOpenCV",Apress,2013

3. Adrian Kaehler, Gary Bradski, "Learning OpenCV 3: Computer Vision in C++ with the OpenCV Library", First Edition,O' Reilly Media, 2017


**REFERENCE BOOKS:**


1. PrateekJoshi, David MillánEscrivá,Vinicius Godoy, "OpenCV by Example", Packt Publishing, 2016.Adrian Rose brock, "Practical Python and OpenCV", Second Edition, PyImage Search, 2016.

2.Mastering OpenCV with Practical Computer Vision Projects Paperback
by Shervin Emami (Author), Khvedchenia Levgen (Author), Naureen Mahmood (Author)

3.Mastering OpenCV 4: A comprehensive guide to building computer vision and image processing applications with C++, 3rd Edition by Roy Shilkrot (Author), David Millán Escrivá (Author)


**WEB RESOURCES:**

1.https://www.youtube.com/watch?v=l_Mhv0rxbQk&list=PLaHodugB5x-Ddy_H951h0VHjOjfzZNCBh

2.https://www.youtube.com/watch?v=oXlwWbU8l2o

| CS606509 - **INTERNET SECURITY** | | | | | | |
|---|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** | |
| | | **3** | **0** | **0** | **3** | |
| **COURSE OBJECTIVES:** | | | | | | |

- To study the fundamental concepts of classical encryption techniques and Crypt Analysis.
- To gain the knowledge of the principles of secret keys management.
- To acquire the concepts of IP Security and its applications
- To study the concepts of Transport layer security and its applications
- To learn the working principle of Email and public key distribution

| **UNIT 1:INTRODUCTION AND BASIC ENCRYPTION** | **9** |
|---|---|
| IntroductionEssentialsofCryptography,EssentialsofNetworkingandInternet,SecurityObjectives,Communication Security, Legal restrictions, Basics of Encryption – Building Blocks of Encryption, Cryptanalysis and Modern Codes, Brute Force cracking of Secret Keys, Choosing Cryptography Algorithms | |
| **UNIT 2: LINK ENCRYPTION AND SECURE KEY MANAGEMENT** | **9** |
| Link Encryption – Inline Encryption, Point to Point Encryption, IP Routed Configuration, Managing Secret Keys –Issues in Secret Key Management, Technology - Random Key Generation, Random Seeding, Pseudorandom Number Generators, Manual Key Distribution, Automatic Rekeying, Key Distribution Centres, Maintaining Keys and SystemSecurity | |
| **UNIT 3: IPLAYER SECURITYAND APPLICATIONS** | **9** |
| Basic Issues in IP Security (IPSEC), Cryptographic Checksums, IP Security Protocol, IPSEC key management, TCP/IP Network Security Protocols, Virtual Private Network(VPN)–Issues in VPN, IPSEC proxy cryptography, IPSECencrypting Router, Site to Site Encryption, Remote Access with IPSEC – problems in IPSEC clients, IPSEC Client, ClienttoServer site access | |
| **UNIT 4: SECURE SOCKET LAYER** | **9** |
| Public Key Cryptography, RSA Encryption, Key Exchange with RSA, Secure Socket Layer (SSL), World Wide Web Transaction Security–Issues in Internet Transaction Security, Transactions on World Wide Web, Security Alternatives for Web Forms, Web Browser with SSL, Web Server with SSL | |
| **UNIT 5: SECURE E-MAIL AND PUBLIC KEY CERTIFICATES** | **9** |
| Secure Email- Email Security Issues, Basics of Internet E-Mail, Offline Message Keying, Digital Signature, Secure Email Client, Public Key Certificates–Distributing Public Keys, Public Key Certificates, Certificate Distribution, Centralized Certification Authority, Hierarchical Certification Authority, Pretty Good Privacy(PGP) | |
| **TOTAL: 45 PERIODS** | |

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

CO1: Interpret basic building blocks of encryption for crypt analysis

CO2: Identify suitable key generation technique for secret key management

CO3: Apply IP security in VPN and Remote Access

CO4: Apply SSL in Worldwide web transactions

CO5: Explore various public key and certificate distribution strategies and its using PGP

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | | | | | | | 2 | | 2 | | |
| CO2 | 2 | 2 | 2 | | | | | | | 2 | | 2 | | |
| CO3 | 2 | 3 | 2 | | | | | | | 2 | | 2 | | |
| CO4 | 2 | 2 | 3 | | | | | | | 2 | | 3 | | |
| CO5 | 3 | 2 | 2 | | | | | | | 2 | | 2 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Richard E.Smith, Internet Cryptography, 6thEdition, Pearson,2011

2.Uyless Black ,"Internet Security Protocols– Protecting IP Traffic", Pearson Education,2001

3.William Stallings, Cryptography and Network Security, 6thEdition, Pearson Education, March2013

**REFERENCE BOOKS:**

1.Bruce Schneier and NeilsFerguson, Practical Cryptography‖, First Edition, Wiley Dream tech India Pvt Ltd, 2003

2. Tim Speed, Juanita Ellis, "Internet Security",Elsevier,2006

3.Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with coding theory",2nd edition, Pearson,200

**WEB RESOURCES:**

https://www.youtube.com/watch?v=zd0U1zNBYNk

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

CS606510 - **INTELLIGENT TRANSPORT SYSTEMS**

| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To describe Fundamentals of intelligent transport systems.
- To learn Concepts of ATIS and its operations.
- To implement Basics of predictive route guidance system.
- To study Concepts of APTS and its operations.
- To analyze General issues related to ITS and environment

**UNIT 1:ITS FUNDAMENTALS** **9**

Introduction to Intelligent Transportation Systems (ITS) –Definition of ITS and Identification of ITS Objectives-Historical Background - Benefits of ITS - ITS Data collection techniques –Detectors - Automatic Vehicle Location (AVL)-Automatic Vehicle Identification(AVI).

**UNIT 2: ADVANCED TRAVELLER INFORMATION SYSTEMS** **9**

Basic concepts - Models - Simulation - LOS of transportation systems - Static, real time and dynamic information -Value of information - Topology - Where and When to receive data - Information flows - Travel support - Dynamic routing.

**UNIT 3: PREDICTIVE ROUTE GUIDANCE** **9**

ITS - Applications - Issues - Information types- Impact on route guidance - Case studies.

**UNIT 4: ADVANCED PUBLIC TRANSPORTATION SYSTEMS(APTS)** **9**

Scope-Components of APTS-Advantages- Limitations ofAPTS-Casestudies -Issues

**UNIT 5: ITS AND ENVIRONMENT** **9**

ITS and Flexibility- ITS and Customer - centricity - ITS and the Environment-General issues and Case studies - Overview of ITS implementations in developed countries.

**TOTAL: 45 PERIODS**

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

CO1: Analyze the various types of traffic and suggesting ITS.

CO2: Plan and design the ATIS

CO3: Plan the predictive route guidance system.

CO4: Analyze the traffic data and able to suggest suitable APTS

CO5: Manage the issues arising out of introduction of ITS.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | | | | | | | 2 | | 2 | | |
| CO2 | 1 | 2 | 2 | | | | | | | 3 | | 2 | | |
| CO3 | 2 | 2 | 3 | | | | | | | 2 | | 2 | | |
| CO4 | 2 | 3 | 2 | | | | | | | 3 | | 2 | | |
| CO5 | 2 | 2 | 3 | | | | | | | 2 | | 2 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.PradipKumarSarkar, AmitKumarJain, "Intelligent Transport Systems", Paperback, PHILearning,2018

2.Intelligent Transportation Systems: Theory and Practice ; Authors: Amit Kumar Tyagi , Niladhuri Sreenath

| |
|---|
| 3.Sussman,J.M., Perspective on ITS, Artech House Publishers, 2005. |
| **REFERENCE BOOKS:** |
| 1.Paolo Baggano,"Intelligent transport Systems Good practices to standards", CRC press,2016. |
| 2.ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by KanPaulChen, John Miles |
| 3.**Intelligent Transportation Systems by Teodor Piatek, Scitus Academics;** Author: **Teodor Piatek** ; Publisher: **Scitus Academics** |
| **WEB RESOURCES:** |
| https://www.youtube.com/watch?v=YDM0Xh3S6JI |
| https://www.youtube.com/watch?v=aNhI2Jstouw |

# VERTICALVI
# DIVERSIFIED COURSES

CS606601 - **DATA ANALYTICS WITH PYTHON (NPTEL)**

| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To study about probability and sampling distributions.
- To study about Hypothetical tests and ANOVA.
- To study about different regression.
- To study about cluster analysis.
- To study about Classifications and Regression Trees.

**PRE-REQUISITES:** Cryptography

**SYLLABUS** **46**

**Week 1 : Introduction to data analytics and Python fundamentals**
**Week 2 : Introduction to probability**
**Week 3 : Sampling and sampling distributions**
**Week 4 : Hypothesis testing**
**Week 5 : Two sample testing and introduction to ANOVA**
**Week 6 : Two way ANOVA and linear regression**
**Week 7 : Linear regression and multiple regression**
**Week 8 : Concepts of MLE and Logistic regression**
**Week 9 : ROC and Regression Analysis Model Building**
**Week 10 : $c^2$ Test and introduction to cluster analysis**
**Week 11 : Clustering analysis**
**Week 12 : Classification and Regression Trees (CART).**

**TOTAL: 45 PERIODS**

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

CO1: Solve problems in probability and probability distributions.

CO2: use ANOVA.

CO3: use different regression models to do predictions.

CO4: use clustering algorithms.

CO5: use classification and regression trees.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. " O'Reilly Media, Inc.".

2.Swaroop, C. H. (2003). A Byte of Python. Python Tutorial.

3.Ken Black, sixth Editing. Business Statistics for Contemporary Decision Making. "John Wiley & Sons, Inc".

**REFERENCE BOOKS:**

1. Jiawei Han and MichelineKamber (2006). Data Mining: Concepts and Techniques. “

2. David W. Hosmer, Stanley Lemeshow (2000). Applied logistic regression (Wiley Series in probability and statistics). “Wiley-Interscience Publication”.

| CS606602 - **PROBLEM SOLVING USING PYTHON** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures – lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

| **UNIT 1: COMPUTATIONAL THINKING AND PROBLEM SOLVING** | **9** |
|---|---|
| Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sortedcards, guess an integer number in a range, Towers of Hanoi. | |
| **UNIT 2: DATA TYPES, EXPRESSIONS, STATEMENTS** | **9** |
| Python interpreter and interactive mode, debugging; values and types: int, float, Boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points. | |
| **UNIT 3: CONTROL FLOW, FUNCTIONS, STRINGS** | **9** |
| Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search | |
| **UNIT 4: LISTS, TUPLES, DICTIONARIES** | **9** |
| Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing – list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation. | |
| **UNIT 5: FILES, MODULES, PACKAGES** | **9** |
| Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word countcopy file, Voter’s age validation, Marks range validation (0-100). | |

**TOTAL: 45 PERIODS**

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

CO1: Develop algorithmic solutions to simple computational problems.

CO2: Develop and execute simple Python programs.

CO3: Write simple Python programs using conditionals and looping for solving problems.

CO4: Decompose a Python program into functions.

CO5: Represent compound data using Python lists, tuples, dictionaries etc.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | - | - | - | - |
| CO2 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | - | - | - | - |
| CO3 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | - | - | - | - |
| CO4 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | - | - | - | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | - | - | - | - |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.

2.Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and programming", 1st Edition, BCS Learning & Development Limited, 2017.

**REFERENCE BOOKS:**

1.Paul Deitel and Harvey Deitel, "Python for Prammers", Pearson Education, 1st Edition, 2021.

2.G Venkatesh and MadhavanMukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.

3.John V Guttag, " Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data'', Third Edition, MIT Press

| CS606603 - **DATA SCIENCE FOR ENGINEERS (NPTEL)** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- Introduce R as a programming language
- Introduce the mathematical foundations required for data science
- Introduce the first level data science algorithms
- Introduce a data analytics problem solving framework
- Introduce a practical capstone case study

Week 1: Course philosophy and introduction to R

Week 2: Linear algebra for data science -Algebraic view - vectors, matrices, product of matrix & vector, rank, null space, solution of over-determined set of equations and pseudo-inverse)- Geometric view - vectors, distance, projections, eigenvalue decomposition

Week 3:Statistics (descriptive statistics, notion of probability, distributions, mean, variance, covariance, covariance matrix, understanding univariate and multivariate normal distributions, introduction to hypothesis testing, confidence interval for estimates)

Week 4: Optimization

Week 5: Typology of data science problems and a solution framework

Week 6: Simple linear regression and verifying assumptions used in linearregression
Multivariate linear regression, model assessment, assessing importance of different variables, subset selection

Week 7: Classification using logistic regression

Week 8: Classification using KNN and k-means clustering

**TOTAL: 45 PERIODS**

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

CO1: Describe a flow process for data science problems

CO2: Classify data science problems into standard typology

CO3: Develop R codes for data science solutions

CO4: Correlate results to the solution approach followed

C05: Assess the solution approach

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.RaghunathanRengaswamy, Resmi Suresh, "Data Science for Engineers", 1st edition, CRC Press.

| **REFERENCE BOOKS:** |
|---|
| 1.https://rpubs.com/uwaterloodatateam/r-programming-reference |

| CS606604 - **DATABASE DESIGN (NPTEL)** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **COURSE OBJECTIVES:** | | | | | |

- To learn ER models with applying ER modelling.
- To learn Relational model.
- To learn Functional depencies and Normal Form.
- To learn File handling, applying Hassing and understanding B+ Trees.
- To learn Transactions.

| **MODULE 1:** |
|---|
| Introductory Concepts (1 session) Databases and Information Systems, An example usage context, Database system concepts and architecture. |
| **MODULE 2:** |
| Semantic Database Design (3 sessions) High-level conceptual modeling, ER Modeling concepts, ER Diagrams, Cardinality constraints, Higher-order relationships, Enhanced ER Model (EER), Weak-entity types, Subclasses and inheritance, Specialization and Generalization, Modeling of UNION types using categories |
| **MODULE 3:** |
| Relational Model, Languages and Systems (7 sessions) Relational algebra (2 sessions): Relational model concepts, Relational integrity constraints, Update operations on relations, Relational algebra model, ER to relational mapping SQL (2 sessions): Data definition in SQL, Queries and update statements, Views, Integrity constraints, Specifying indexes, Embedded SQL. IBM DB2 case study (2 sessions): Architecture of DB2, Data definition and manipulation in DB2. EER to Relational mapping (1 session). |
| **MODULE 4:** |
| Database design using the relational model (4 sessions) Functional dependencies (2 sessions): Keys in a relational model, Concept of functional dependencies, Normal forms based on primary keys, Boyce-Codd Normal Forms Further Dependencies (2 sessions): Multi-values dependencies and fourth normal form, Join dependencies and fifth normal form, Inclusion dependencies, Other dependencies and normal forms |
| **MODULE 5:** |
| Storage and Indexing Structures (6 sessions) Storage structures (3 sessions): Secondary storage devices, Buffering of blocks, File Organization, Heaps, Sorted Files, Hashing and overflow handling techniques, Dynamic hashing, Extensible hashing, Other file organizations Indexing methods (3 sessions): Basic terminology, Primary indexes, Clustering index, Secondary index, Multilevel indexes, ISAM, B-trees, B+ trees, inserting and searching algorithms for B+ trees, Other indexing methods |
| **MODULES 6:** |
| Transaction Processing and Concurrency Control (6 sessions) Transaction Fundamentals (3 sessions): OLTP environments, Concurrency issues, need for transactions, Necessary properties of transactions (ACID properties), Transaction states, serializability, Serial schedules, Conflict serializability, View serializability, Recoverable and non-recoverable |

schedules, Cascading rollbacks, Cascadeless schedules Concurrency control

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

CO1: Design ER models.

CO2: Identify relational models.

CO3: Apply normal forms in splitting tables.

CO4: Identify the file forms and handle them and use hashing.

CO5: use transactions in DBMS.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database Design",McGraw Hill Education; Sixth edition (1 December 2013).

**REFERENCE BOOKS:**

1..C. J. Date, "Database Design and Relational Theory: Normal Forms and All That Jazz", Apress, December 2019.

2.Michael J. Hernandez, "Database Design for Mere Mortals: A guide to relational database design".

CS606605 - **MATLAB PROGRAMMING FOR ENGINEERS**

| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To Understand basic MATLAB concepts
- To learn Vectors and variables
- To know about the command statements
- To develop codes
- To understand Segmentation concepts

**UNIT 1: INTRODUCTION** **9**

Create, edit, and open scripts- Write Comments in Lines and Blocks- Using MATLAB for a Personal Budget- Personalize MATLAB Colors- Start MATLAB with an Encouraging Note

**UNIT 2: VECTORS AND VARIABLES** **9**

Create Vectors and Matrices-Unsolved: Valid and Invalid Matrices- Working with Text (Characters and Strings)- HTML Table from MATLAB Code- Round pi to N significant Digits- File/folder Information Using Structures

**UNIT 3: COMMANDS STATEMENTS** **9**

Create a Hilbert Matrix Using for-loops- Unsolved: Compare two while Loops- Save and Load Multiple Files- Import Formatted Text Data- Import Excel-format Data

**UNIT 4: TRANSLATE FORMULAS INTO CODE** **9**

Trig Functions and Gaussians- Laplace and log-normal Distributions- Complex Numbers and Euler's Formula- Piecewise Functions- Piecewise Function in one line of Code.

**UNIT 5: SEGMENTATION** **9**

Threshold-based Time Series Segmentation- Derivative-based Time Series Segmentation- Intensity-based Image Segmentation- Identify Neurons in a Mouse Brain Slice

**TOTAL: 45 PERIODS**

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

CO1: Understand basic MATLAB concepts.

CO2: learn Vectors and variables.

CO3: Understand to know about the command statements.

CO4: Develop the codes.

CO5: Understand Segmentation concepts

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - |
| CO5 | 2 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.MATLAB Programming for Engineers, 6th edition, Stephen J. Chapman, BAE Systems 2020.

2.MATLAB Programming for Engineers Perfect Paperback – by Stephen J. Chapman 2012.

| **REFERENCE BOOKS:** |
| --- |
| 1.MATLAB and its Applications in Engineering, 2e Paperback – 2016, by Bansal ,Goel, Sharma. |
| 2.Programming and Engineering Computing with MATLAB 2017, Huei-Huang Lee :Sdc Publications. |

| CS606606 - **ROBOTICS AND ITS APPLICATIONS** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- Identify robots and its peripherals for satisfactory operation and control of robots for industrial and non-industrial applications.

**UNIT 1: ROBOT BASICS** **9**

Robot-Basic concepts, Need, Law, History, Anatomy, specifications. Robot configurations-cartesian, cylinder, polar and articulate. Robot wrist mechanism, Precision and accuracy of robot.

**UNIT 2: ROBOT ELEMENTS** **9**

End effectors-Classification, Types of Mechanical actuation, Gripper design, Robot drive system Types, Position and velocity feedback devices-Robot joints and links-Types, Motion interpolation.

**UNIT 3: ROBOT KINEMATICS AND CONTROL** **9**

Robot kinematics – Basics of direct and inverse kinematics, Robot trajectories, 2D and 3D Transformation-Scaling, Rotation, Translation Homogeneous transformation. Control of robot manipulators – Point to point, Continuous Path Control, Robot programming

**UNIT 4: ROBOT SENSORS** **9**

Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors. Force sensor-Light sensors, Pressure sensors, Introduction to Machine Vision and Artificial Intelligence.

**UNIT 5: ROBOT APPLICATIONS** **9**

Industrial applications of robots, Medical, Household, Entertainment, Space, Underwater, Defense, Disaster management. Applications, Micro and Nanorobots, Future Applications.

**TOTAL: 45 PERIODS**

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

CO1: list and explain the basic elements of industrial robots.

CO2: analyze robot kinematics and its control methods.

CO3: Classify the various sensors used in robots for better performance.

CO4: summarize various industrial and non-industrial robots.

CO5: Implement the real time applications.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 2 | 2 | - | 2 | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | 2 | 1 | 1 |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Mikell P. Groover, Mitchell Weiss, Roger N Nagel, Nicholas G Odrey, "Industrial Robotics Technology, Programming and Applications", Tata –McGraw Hill Pub. Co., 2008.

2.Deb.S.R and Sankha Deb, "Robotics Technology and Flexible Automation", Tata

| |
|---|
| McGraw Hill Publishing Company Limited, 2010. |
| 3.Klafter.R.D, Chmielewski.T.A, and Noggin's., "Robot Engineering: An Integrated Approach"', Prentice Hall of India Pvt. Ltd., 1994. |
| **REFERENCE BOOKS:** |
| 1.Fu.K.S, Gonzalez.R.C&Lee.C.S.G, "Robotics control, sensing, vision and intelligence", Tata- McGraw Hill Pub. Co., 2008 5. Yu. "Industrial Robotics", MIR Publishers Moscow, 1985. |

CS606607 - **ADHOC NETWORKS**

| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- Learn Ad hoc network and Sensor Network fundamentals.
- Understand the different routing protocols.
- Have an in-depth knowledge on sensor network architecture and design issues.
- Understand the transport layer and security issues possible in Ad hoc and Sensor networks.
- Have an exposure to mote programming platforms and tools

**UNIT 1: INTRODUCTION AND ROUTING PROTOCOLS** **9**

Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Example commercial applications of Ad hoc networking, Ad hoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–Demand Distance Vector Routing (AODV).

**UNIT 2: SENSOR NETWORKS – INTRODUCTION & ARCHITECTURES** **9**

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture – Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture – Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.

**UNIT 3: WSN NETWORKING CONCEPTS AND PROTOCOLS** **9**

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts – S-MAC, The Mediation Device Protocol, Contention based protocols – PAMAS, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols Energy Efficient Routing, Challenges and Issues in Transport layer protocol.

**UNIT 4: SENSOR NETWORK SECURITY** **9**

Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, black hole attack, flooding attack. Key Distribution and Management, Secure Routing – SPINS, reliability requirements in sensor networks.

**UNIT 5: SENSOR NETWORK PLATFORMS AND TOOLS** **9**

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms – TinyOS, nesC, CONTIKIOS, Node-level Simulators – NS2 and its extension to sensor networks, COOJA, TOSSIM, Programming beyond individual nodes – State centric programming.

**TOTAL: 45 PERIODS**

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

CO1: Know the basics of Ad hoc networks and Wireless Sensor Networks.

CO2: Apply this knowledge to identify the suitable routing algorithm based on the network and user requirement.

CO3: Apply the knowledge to identify appropriate physical and MAC layer protocols.

CO4: Understand the transport layer and security issues possible in Ad hoc and sensor networks.

CO5: Be familiar with the OS used in Wireless Sensor Networks and build basic modules.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | 1 | 1 |
| CO3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | 2 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.C.Siva Ram Murthy and B. S. Manoj, Ad hoc Wireless Networks Architecture and Protocols, 2nd edition, Pearson Edition, 2007. 2. Charles E. Perkins, Ad hoc Networking, Addison – Wesley, 2000.

**REFERENCE BOOKS:**

1.Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, "Mobile ad-hoc networking", Wiley-IEEE press, 2004.

2.Mohammad Ilyas, "The handbook of ad-hoc wireless networks", CRC press, 2002.

3.T. Camp, J. Boleng, and V. Davies "A Survey of Mobility Models for Ad-hoc Network"

4.Research, "Wireless Communication, and Mobile Computing". Special Issue on Mobile Ad-hoc Networking Research, Trends and Applications, Vol. 2, no. 5, 2002, pp. 483 – 502.

CS606608 - **PRINCIPLES OF DISTRIBUTED SYSTEMS**

| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To understand Transactions and Concurrency control.
- To understand Security issues.
- To Understanding Distributed shared memory.
- To design distributed systems for basic level applications.
- To learn about distributed shared memory.

| **UNIT 1: INTRODUCTION** | **9** |
|---|---|

Characterization of Distributed Systems-Introduction, Examples of Distributed systems, Resource sharing and web, challenges, System models -Introduction, Architectural and Fundamental models, Networking and Internetworking, Interprocess Communication, Distributed objects and Remote Invocation-Introduction, Communication between distributed objects, RPC, Events and notifications, Case study-Java RMI.

| **UNIT 2: OPERATING SYSTEM** | **9** |
|---|---|

Operating System Support- Introduction, OS layer, Protection, Processes and Threads, Communication and Invocation, Operating system architecture, Distributed File Systems-Introduction, File Service architecture.

| **UNIT 3: PEER TO PEER SYSTEMS** | **9** |
|---|---|

Peer to Peer Systems–Introduction, Napster and its legacy, Peer to Peer middleware, Routing overlays, Overlay case studies-Pastry, Tapestry, Application case studies-Squirrel, OceanStore. Time and Global States-Introduction, Clocks, events and Process states, Synchronizing physical clocks, logical time and logical clocks, global states, distributed debugging. Coordination and Agreement-Introduction, Distributed mutual exclusion, Elections, Multicast communication, consensus and related problems.

| **UNIT 4: TRANSACTIONS AND CONCURRENCY** | **9** |
|---|---|

Transactions and Concurrency Control-Introduction, Transactions, Nested Transactions, Locks, Optimistic concurrency control, Timestamp ordering. Distributed Transactions-Introduction, Flat and Nested Distributed Transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery.

| **UNIT 5: REPLICATION** | **9** |
|---|---|

Replication-Introduction, System model and group communication, Fault tolerant services, Transactions with replicated data. Distributed shared memory, Design and Implementation issues, Consistency models.

**TOTAL: 45 PERIODS**

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

CO1: Understand Transactions and Concurrency control.

CO2: Understand Security issues.

CO3: Design distributed systems for basic level applications.

CO4: Understanding Distributed shared memory.

CO5: Implementation of the models.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | 2 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | - | - |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Cormen, C. Leiserson, R. Rivest and C. Stein, "Introduction to Algorithms", Third Edition, McGraw-Hill, 2009.

2.R. Motwani and P. Raghavan, Randomized Algorithms, Cambridge University Press, 1995. J. J. McConnell, "Analysis of Algorithms: An Active Learning Approach", Jones & Bartlett Publishers, 2001.

3.D. E. Knuth, Art of Computer Programming, Volume 3, "Sorting and Searching", Second Edition, Addison-Wesley Professional, 1998.

4.S. Dasgupta, C. H. Papadimitriou and U. V. Vazirani, "Algorithms", McGraw-Hill, 2008.

**REFERENCE BOOKS:**

1."Distributed Systems – Principles and Paradigms", A.S. Tanenbaum and M.V. Steen, Pearson Education.

2.Distributed Computing, Principles, Algorithms and Systems, Ajay D. Kshemakalyani and MukeshSinghal, Cambridge, rp 2010.

CS606609 - **PYTHON SCRIPTING**

| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To Learn Fundamentals of Python
- To understand Control Flow Structures
- To know about Lists, Tuples, Sets and Dictionaries
- To create Functions and Modules
- To understand String Processing and File Handling

**UNIT 1: FUNDAMENTALS OF PYTHON** **9**

Introduction to Python- History of Python- Python Features- Python Applications- Python Applications- Elements of Python- Keywords and Identifiers- Assigning Values to Variables- Data types- Type Casting- Input-Output functions: input, print- Operators.

**UNIT 2: CONTROL FLOW STRUCTURES** **9**

Introduction to Control Structures- if Statement- if else Statement- Nested if-else- if-elif-else statements- Switch Statement- loop- while loop- for loop- Nested loops- break statement- continue statement- Pass Statement.

**UNIT 3: LISTS, TUPLES, SETS AND DICTIONARIES** **9**

Lists and operations on Lists- Create Python Lists- List operations- List Slicing- Add/Change List Elements- Insert( )- Delete- Remove( ) and pop( )- Tuples and operations on Tuples- Characteristics of Tuple- Concatenation - Sets and operations on Sets.

**UNIT 4: FUNCTIONS AND MODULES** **9**

Introduction to Python User defined Function- Passing parameters to a function and returning values from a function- Python Default Arguments- Recursion- Modules and Packages- rand module - Random numbers generators.

**UNIT 5: STRING PROCESSING AND FILE HANDLING** **9**

Introduction to String- String Operation- Add strings to list- Concatenate lists of strings- Access String elements using index operator- String functions- String functions- File Handling functions.

**TOTAL: 45 PERIODS**

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

CO1: Understand the Fundamentals of Python

CO2: Understand the Control Flow Structures

CO3: know about Lists, Tuples, Sets and Dictionaries

CO4: create Functions and Modules

CO5: understand String Processing and File Handling

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Jones, M. (2013), "Python for Biologists: A complete programming course for beginners" Create Space Independent Publishing Platform 1st edition. ISBN: 978-1492346135

**REFERENCE BOOKS:**

1.Pilgrim M, (2009), "Dive into Python 3" Apress ISBN: 978-1430224150.

CS606610 - **IMPLEMENT RUST**

| **Course Category: Programme Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To understand the Rust language basics
- To learn advanced Rust
- To Implement the small programs
- To understand the practical engineering skills
- To design the APIs concepts.

**UNIT 1: RUST LANGUAGE BASICS** **9**

Basic syntax-pointers, references, and (im)mutability-ownership, borrowing, and lifetimes-generic functions and types implementing and defining traits.

**UNIT 2: ADVANCED RUST** **9**

Concurrency-networking-Iterators-futures and async-lient-side web programming via Web Assembly-mixing Rust with C.

**UNIT 3: IMPLEMENTATION** **9**

How big are things, and where are they stored? Where does allocation happen?-monomorphization versus dynamic dispatch translating Rust to C

**UNIT 4: PRACTICAL ENGINEERING SKILLS** **9**

Unit and integration testing-benchmarking and optimization-source control and continuous integration-writing API documentation

**UNIT 5: DESIGN SKILLS** **9**

Factoring components into minimum viable concepts-designing APIs for safety and efficiency-improving code clarity

**TOTAL: 45 PERIODS**

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

CO1: Understand the Rust language basics

CO2: Learn advanced Rust

CO3: Implement the small programs

CO4: Understand the practical engineering skills

CO5: Design the APIs concepts

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - |
| CO5 | 2 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | - | - |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Programming Rust, 2nd Edition by Jim Blandy, Jason Orendorff, Leonora F . S. Tindall Released June 2021Publisher(s): O'Reilly Media, Inc. ISBN:

| |
|---|
| 9781492052548. |
| REFERENCE BOOKS: |
| https://doc.rust-lang.org/book/ch00-00-introduction.html |

# VERTICAL VII
# ARITIFICIAL INTELLIGENCE

| CS606701 - **ARTIFICIAL INTELLIGENCE IN FINANCE** | | | | | |
|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

COURSE OBJECTIVES:

- To explore the concepts of machine intelligence
- To understand the types of Finance, and Concepts of AI in Finance
- To discuss the neural networks and reinforcement learning
- To learn algorithmic trading and test it in python environment
- To know the role of AI in finance and its applications

| **UNIT 1:MACHINE INTELLIGENCE** | 9 |
|---|---|

Artificial Intelligence: Algorithms, Neural Networks— Importance of Data. Super Intelligence: Forms of Intelligence – Paths to Superintelligence – Intelligence Explosion.

| **UNIT-2 : FINANCE AND MACHINE LEARNING** | 9 |
|---|---|

Normative Finance: Uncertainty and Risk – Expected Utility Theory – Mean – Variance Portfolio Theory – Capital Asset Pricing Model – Arbitrage Pricing Theory. Data-Driven Finance: Scientific Method – Financial Econometrics and Regression – Data Availability, Normative Theories Revisited – Debunking Central Assumptions. Machine Learning. AI– First Finance

| **UNIT-3 : STATISTICAL INEFFICIENCIES** | 9 |
|---|---|

Dense Neural Networks: Baseline prediction – Normalization – Dropout – Regularization – Bagging – Optimizers .Recurrent Neural Networks: Second Example – Financial Price Series – Financial Return Series – Financial Features. Reinforcement Learning : Fundamental Notations – OpenAI Gym - Monte Carlo Agent – Neural Network Agent – DQL Agent – Simple Finance Gym - Better Finance Gym – FQL Agent

| **UNIT-4 : ALGORITHMIC TRADING** | 9 |
|---|---|

Vectorized Backtesting : Backtesting an SMA-Based Strategy - Backtesting a Daily DNN-Based Strategy – Backtesting an Intraday DNN-Based Strategy. Risk Management: Trading Bot, Vectorized Backtesting Event-Based Backtesting – Assessing Risk – Backtesting Risk Measures. Execution and Deployment : Oando Account – Data Retrieval – Order Execution Trading Bot.

| **UNIT-5 : OUTLOOK** | 9 |
|---|---|

AI-Based Competition: AI and Finance – Lack of Standardization – Education and Training Fight for Resources – Market Impact – Competitive Scenarios – Risks – Regulation and Oversight. Financial Singularity.

TOTAL: 45 PERIODS

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

CO1: Explore the main concepts of AI and machine learning

CO2: Use financial types, metrics and machine learning techniques in AI

CO3: Apply neural networks in Finance

CO4: Explore algorithmic trading that AI and machine learning techniques can add to various portfolio and risk management strategies

CO5: Apply the concepts of AI in financial applications

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | - | - | - | 2 | - | - | -- | | 2 | | 2 | - | - |
| CO2 | - | 2 | - | - | 2 | - | - | - | - | 2 | - | - | - | - |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO3 | 2 | - | - | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO4 | - | - | - | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO5 | - | 2 | - | - | 2 | - | - | - | - | 2 | - | 2 | - | - |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Yves Hilpisch,"Artificial Intelligence in Finance – A Python-Based Guide", O'Reilly Media, Inc. First Edition, 2020

**REFERENCE BOOKS:**

1.Oliver Wyman,"Artificial Intelligence Applications in Financial Services",Marsh & McLennan, First Edition, 2019

**WEB RESOURCES:**

1.https://www.mdpi.com/2227-7072/8/3/45

2.https://community.ibm.com/community/user/ai-datascience/blogs/stephen-crenshaw/2021/11/14/artificial-intelligence-in-finance-opportunities-a

CS606702 - OPTIMIZATION FOR MACHINE LEARNING
(NPTEL)

| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To Know The Basics of Linear Algebra and Calculus
- To learn the Gradient Descent Concepts
- To Analyse the Convex and Non Convex Optimization problems
- To get the knowledge of Variants of Gradient Descent
- To Learn the Newton's Method

| **Week 1:** | 9 |
|---|---|
| Basics of Linear Algebra and Calculus: Subspaces, EigenValue Decomposition, Singular Value Decomposition - Algorithms and Methods, PSD Matrices and Kernel Functions, Vector Calculus | |
| **Week 2:** | 9 |
| Gradient Descent: math, programming basic optimisation problems and their solutions | |
| **Week 3:** | 9 |
| Convex Functions, First and Second Order Conditions for Optimizations, Convex and Non Convex Optimization problems in Machine Learning. | |
| **Week-4 :** | 9 |
| Variants of Gradient Descent: Projected, Stochastic, Proximal, Accelerated, Coordinate Descent, Training a Neural Network: Theory | |
| **Week-5 :** | 9 |
| Newton's Method, Optimization for ML in practice: Pytorch/Tensor Flow. Training a Neural Network, Implementation | |
| TOTAL:45 PERIODS | |

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

CO1: Know The Basics of Linear Algebra and Calculus

CO2: learn the Gradient Descent Concepts

CO3: Analyze the Convex and Non Convex Optimization problems

CO4: Get the knowledge of Variants of Gradient Descent

CO5: Learn the Newton's Method

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | - | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO2 | 2 | 1 | - | 2 | - | - | - | - | - | 2 | - | 2 | - | - |
| CO3 | - | 2 | 2 | - | - | - | - | - | - | 2 | - | 1 | - | - |
| CO4 | 2 | 2 | - | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO5 | 1 | 2 | - | 2 | 2 | - | - | - | - | 2 | - | 2 | - | - |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

| |
|---|
| 1.Foundations of Data Science, Avrim Blum and Ravi Kannan, Hindustan Book Agency/Cambridge University Press<br>2.Linear Algebra and Learning from Data, Gilbert Strang |
| **REFERENCE BOOKS:** |
| 1.Convex Optimisation by Stephen Boyd<br>2.Optimisation for Machine Learning by Suvrit Sra, MIT Press. |
| **WEB RESOURCES:** |
| 1.https://onlinecourses.nptel.ac.in/noc23_cs64/preview |
| 2.https://www.tensorflow.org/ |

CS606703 - **DESIGN THINKING IN ARTIFICIAL INTELLIGENCE**

| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To learn the different views of learning
- To study the various search strategies
- To study the knowledge representation framework
- To understand the transition from micro world to knowledge representation
- To learn the brain architecture

| **UNIT 1:INTRODUCTION** | **9** |
|---|---|

Mind Design – Perspectives and Things – Turing Test – Intentionality –Formal systems – Automatic Formal systems – Computers and Intelligence – GOFAI – Interpreted Formal systems – New Fangled AI – Connectionist Networks – Embodied and Embedded AI – Imitation Game– Critique of the new problem – Machines Concerned – Digital Computers – Universality – Contrary Views – Learning Machines.

| **UNIT-2 : SEARCH STRATEGIES** | **9** |
|---|---|

Intentional Strategy –Working – True Believers – Computer Science as Empirical Inquiry: Symbols and Search – Symbols and physical symbol systems – Laws of Qualitative Structure – Development of the symbol–system hypothesis – Evidence –Heuristic Search – Problem Solving – Search Trees – Forms of Intelligence – Intelligence without much Search.

| **UNIT-3 : FRAMEWORK FOR REPRESENTING KNOWLEDGE** | **9** |
|---|---|

Frames – Artificial intelligence and human problem solving – Language, understanding, and scenarios – Words, sentences, and meanings – Scenarios and questions – Questions, systems, and cases – Learning, memory, and paradigms – Requests to memory – Clusters, classes, and a geographic analogy – Analogies and alternative descriptions – Frames and paradigms.

| **UNIT-4 : KNOWLEDGE REPRESENTATION: AI AT AN IMPASSE** | **9** |
|---|---|

Micro–worlds – SHRDLU: Understanding Natural Language – Scene Parsing And Computer Vision – Learning New Concepts or Categories – Knowledge Representation –Scripts and Primitive Actions – KRL: A Knowledge – Representation Language – Minds, Brains, and Programs

| **UNIT-5 : THE ARCHITECTURE OF MIND: A CONNECTIONIST APPROACH** | **9** |
|---|---|

Brain–Style Computation –The Connectionist Framework – Computational Features Of Connectionist Models – State Of The Art –Architectures – Scaling Problem – Generalization Problem – Connectionist Modeling: Neural Computation / Mental Connections – Levels Of Analysis: Neural And Mental Structures – Symbolic Paradigm – Subsymbolic Paradigm – Semantic Interpretation – The Subsymbolic Level – Subsymbolic Computation – Subsymbolic Inference And The Statistical Connection – Higher–Level Descriptions.

TOTAL: 45 PERIODS

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

CO1: Learn the different views of learning

CO2: Study the various search strategies

CO3: Study the knowledge representation framework

CO4: Analyze the transition from micro world to knowledge representation

CO5: Design the brain architecture

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | - | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO2 | 2 | - | 2 | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO3 | 2 | 2 | - | 2 | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO4 | 2 | - | 2 | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO5 | 2 | 2 | - | - | 2 | - | - | - | - | 2 | - | 2 | - | - |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.John Haugeland, "Mind Design II – Philosophy Psychology Artificial Intelligence", The MIT Press, Second Edition, 1997

**REFERENCE BOOKS:**

1.Denis Rithman , "Artificial Intelligence By Example", Packt Publishers, First Edition, 2018
2.Melanie Mitchell,"Artificial Intelligence: A Guide for Thinking Humans", Penguin Publishers, First Edition, 2019
3.Michael Lewrick, Patrick Link and Larry Leifer, " The Design Thinking Playbook", Wiley Publishers, First Edition, 2019

**WEB RESOURCES:**

1.https://nexocode.com/blog/posts/applying-design-thinking-to-ai/

2.https://bootcamp.uxdesign.cc/about-ai-and-the-design-thinking-process-in-ux-design-e21b3ba1ed9c?gi=9b9a2e4cd85b

| CS606704 - **ARTIFICIAL INTELLIGENCE AND REINFORCEMENT LEARNING** | | | | | |
|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- Importance of AI in problem solving.
- Basics of AI logics and develop plan using AI.
- Probability in AI for decision making.
- Basics of Reinforcement Learning and use it for untrained learning.
- The applications using AI and RL.

**UNIT 1: ARTIFICIAL INTELLIGENCE BASED PROBLEM SOLVING** **9**

Intelligent Agents, Problem Formulation, Uninformed Search Strategies, Heuristics Search Strategies (A*), Local Search Algorithms and optimization problems, Problem Decomposition (AO*) and Rule Based Systems.

**UNIT-2 : KNOWLEDGE AND PLANNING** **9**

Logic and inferences: Logic Agents, First Order Logic, Forward and Backward chaining. Planning: Forward and Backward Search, Goal Stack Planning.

**UNIT-3 : REASONING AND DECISION MAKING** **9**

Reasoning: Quantifying Uncertainty and Probabilistic Reasoning–Semantics and Inference in Bayesian Networks, Probabilistic Reasoning over time – Hidden Markov Models, Kalman filters. Decision Making: Sequential Decision Problems, Value Iteration, Policy Iteration, Markov Decision Process (MDP).

**UNIT-4 : REINFORCEMENT LEARNING** **9**

Forms of Learning, Elements of Reinforcement Learning (RL), Agent - Environment Interface, Passive RL, Active RL, Multi- armed Bandit, Monte Carlo Method, Temporal Difference Learning, Eligibility Traces, DQN & Policy Gradient Approaches.

**UNIT-5 : AI AND RL APPLICATION** **9**

Future of AI, RL applications and Case study: Alpha Go, Universal Robots - cobots, Mars Curiosity Rover and Sophia.

TOTAL: 45 PERIODS

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

CO1: Learn the problem using AI.

CO2: Develop AI logics and plan.

CO3: Develop AI based Decision Making.

CO4: Analyse various RL algorithms.

CO5: Develop AI and RL based System.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | - | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO2 | 2 | - | - | 2 | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO3 | 2 | 2 | - | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO4 | 2 | 2 | 2 | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO5 | 2 | - | 2 | - | 2 | - | - | - | - | 2 | - | 2 | - | - |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Russell, S.J. and Norvig, P., "Artificial intelligence – A modern approach", 3rd edition, Pearson, 2015.
2.Richard S. Sutton, Andrew G Barto, "Reinforcement Learning – An Introduction", MIT Press, 2018.

**REFERENCE BOOKS:**

1.M. Nagenevtsky, "Artificial Intelligence – a guide to intelligent systems" Addision Wesley, 3rd Edition, 2011.
2.Sebastian Thrun, Wolfram Burgard, & Dieter Fox, "Probabilistic Robotics" MIT Press. 2005.
3.Deepak Khemani, "A First Course in Artificial Intelligence",McGraw Hill Education; 1st edition (1 July 2017.
4.Csaba Szepesvari, "Algorithms for Reinforcement Learning", Morgan and Claypool Publishers; 1st edition, 2010

**WEB RESOURCES:**

1.https://analyticsindiamag.com/top-resources-to-learn-reinforcement-learning-in-2022/

2.https://aws.amazon.com/machine-learning/ai-services/

CS606705 - MACHINE LEARNING FOR SOIL AND CROP MANAGEMENT (NPTEL)

| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To Learn the Overview Of Ml And Dl Applications
- To get the knowledge of Classification And Clustering Methods In Agriculture
- To know the Ml And Dl For Soil And Crop Image Processing
- To Analyse the : Hyper spectral Remote Sensing
- To apply the Digital Soil Mapping With Continuous Variables

Week 1: General Overview Of Ml And Dl Applications In Agriculture
Week 2: Basics Of Multivariate Data Analytics
Week 3: Principal Component Analysis And Regression Applications In Agriculture
Week 4: Applications Of Classification And Clustering Methods In Agriculture
Week 5: Diffuse Reflectance Spectroscopy: Basics And Applications For Crop And Soil
Week 6: Use Of Ml For Portable Proximal Soil And Crop Sensors
Week 7: Ml And Dl For Soil And Crop Image Processing
Week 8: Ova And Ml Applications In Agriculture
Week 9: Hyper spectral Remote Sensing And Ml Applications In Agriculture
Week 10: Digital Soil Mapping – General Overview
Week 11: Digital Soil Mapping With Continuous Variables
Week 12: Digital Soil Mapping With Categorical Variables

TOTAL: 45 PERIODS

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

CO1: Learn the Overview Of Ml And Dl Applications
CO2: Get the knowledge of Classification And Clustering Methods In Agriculture
CO3: Know the Ml And Dl For Soil And Crop Image Processing
CO4: Analyze the : Hyper spectral Remote Sensing
CO5: Apply the Digital Soil Mapping With Continuous Variables

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | - | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO2 | 2 | 2 | - | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO3 | 2 | 2 | 2 | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO4 | 2 | 2 | - | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO5 | 2 | 2 | - | - | 2 | - | - | - | - | 2 | - | 2 | - | - |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Introduction to Multivariate Statistical Analysis in Chemometrics by Kurt Varmuza and Peter Filzmoser

**REFERENCE BOOKS:**

2.Using R for Digital Soil Mapping by Malone, Minasny, and McBratney

**WEB RESOURCES:**

1.https://onlinecourses.nptel.ac.in/noc23_ag04/preview

2.https://onlinecourses.nptel.ac.in/noc22_ag05/preview

CS606706 - **COMPUTATIONAL INTELLIGENCE**

| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To learn the basic concepts of computational intelligence
- To understand the problem solving search algorithms
- To study the representation of knowledge and the reasoning process
- To explore models used to solve uncertainty problems
- To introduce models that learn from samples of data

**UNIT 1:INTRODUCTION** **9**

Introduction –Foundations of AI- History of AI- Intelligent agents – Agents and Environments-Concepts of Rationality - Nature of Environments- Structure of Agents.

**UNIT-2 : PROBLEM SOLVING** 9

Solving problems by searching - Problem solving Agents - Example Problems - Searching for solutions - Uninformed search strategies - Informed search strategies: Greedy best first search, A* search - Memory bounded Heuristic search - Heuristic functions-Local search algorithms and optimization problems-Local search in continuous spaces.

**UNIT-3 : KNOWLEDGE AND REASONING** **9**

Logic Agents: Knowledge based agents - Wumpus world - Logic - Propositional logic - Syntax and Semantic of FOL - Using FOL - Propositional vs First order inference - Unification and Lifting - Forward chaining - Backward chaining – Resolution.

**UNIT-4 : UNCERTAIN KNOWLEDGE AND REASONING** **9**

Quantifying Uncertainty - Acting under Uncertainty - Basic probability notation – Axioms of Probability- Inference using Full joint distribution - Independence - Bayes rule - Probabilistic Reasoning - Semantics of Bayesian networks - Bayesian nets with continuous variable – Inference by enumeration- Variable elimination algorithm-Approximate Inference in Bayesian networks.

**UNIT-5 : LEARNING** 9

Forms of learning - Supervised learning - Learning decision trees – Theory of learning-Regression and Classification with Linear models-Artificial Neural networks-Nonparametric models-Support Vector Machines-Ensemble learning.

TOTAL: 45 PERIODS

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

CO1: Exploit the structure of agents

CO2: Apply searching and optimization algorithms for real world problems

CO3: Represent knowledge in propositional logic and FOL

CO4: Construct network models to represent knowledge in uncertain domain

CO5: Apply learning algorithms to solve real world problems

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | - | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO2 | 2 | 2 | - | 2 | - | - | - | - | - | 2 | - | 2 | - | - |
| CO3 | 2 | 2 | 2 | 2 | 2 | - | - | - | - | 2 | - | 2 | - | - |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO4 | 2 | 2 | - | - | - | - | - | - | - | 2 | - | 2 | - | - |
| CO5 | 2 | 2 | 2 | 2 | - | - | - | - | - | 2 | - | 2 | - | - |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson education, Third edition, 2014

**REFERENCE BOOKS:**

1.Nils.J.Nilsson, "Artificial Intelligence: A new synthesis", Elsevier, July 2003

2.Andries P.Engelbrecht, "Computational Intelligence: An Introduction", John Wiley & Sons, 2nd edition, 2007

3.John Fulcher, L.C. Jain, "Computational Intelligence: A Compendium, Studies in Computational Intelligence", Vol.115, Springer,2008

**WEB RESOURCES:**

1.https://cis.ieee.org/

2.https://www.hindawi.com/journals/cin/

CS606707 - DEEP LEARNING FOR VISUAL COMPUTING
(NPTEL)

| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

COURSE OBJECTIVES:

- To Learn the Visual Computing and Neural Networks
- To get the knowledge of Convolutional Neural Networks
- To Analyse the Very Deep Cnn For Classification
- To know the Generative Models With Adversarial Learning
- To apply the Neural Networks (Rnn) For Video Classification

**SYLLABUS**

Week 1: Introduction To Visual Computing And Neural Networks
Week 2: Multilayer Perceptron To Deep Neural Networks With Autoencoders
Week 3: Autoencoders For Representation Learning And Mlp Initialization
Week 4: Stacked, Sparse, Denoising Autoencoders And Ladder Training
Week 5: Cost Functions, Learning Rate Dynamics And Optimization
Week 6: Introduction To Convolutional Neural Networks (Cnn) And Lenet
Week 7: Convolutional Autoencoders And Deep Cnn (Alexnet, Vggnet)
Week 8: Very Deep Cnn For Classification (Googlenet, Resnet, Densenet)
Week 9: Computational Complexity And Transfer Learning Of A Network
Week 10:Object Localization (Rcnn) And Semantic Segmentation
Week 11:Generative Models With Adversarial Learning
Week 12: Recurrent Neural Networks (Rnn) For Video Classification

TOTAL: 45 PERIODS

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

CO1: Learn the Visual Computing and Neural Networks
CO2: Get the knowledge of Convolutional Neural Networks
CO3: Analyze the Very Deep Cnn For Classification
CO4: Know the Generative Models With Adversarial Learning
CO5: Apply the Neural Networks (Rnn) For Video Classification

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | - | - | - | - | - | - | - | 2 | - | 2 | - | - |
| CO2 | 2 | 2 | 2 | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO3 | 2 | 2 | - | 3 | - | - | - | - | - | 2 | - | 2 | - | - |
| CO4 | 2 | 2 | - | - | - | - | - | - | - | 2 | - | 2 | - | - |
| CO5 | 2 | 2 | 2 | - | 2 | - | - | - | - | 2 | - | 2 | - | - |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Goodfellow, Y, Bengio, A. Courville, "Deep Learning", MIT Press, 2016

**REFERENCE BOOKS:**

1.S. Haykin, "Neural Networks and Learning Machines",3e,Pearson, 2008.

**WEB RESOURCES:**

1.https://onlinecourses.nptel.ac.in/noc23_ee53/preview

2.https://archive.nptel.ac.in/courses/108/105/108105103/

| CS606708 - **SOFT COMPUTING** | | | | | |
|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
| | | 3 | 0 | 0 | 3 |
| COURSE OBJECTIVES: | | | | | |

- To learn the basic concepts of Soft Computing
- To become familiar with various techniques like neural networks, genetic algorithms
- To apply soft computing techniques to solve problems.
- To Learn the Genetic Algorithm
- To Create Hybrid Systems using soft computing tools

| **UNIT 1:INTRODUCTION TO SOFT COMPUTING** | 9 |
|---|---|

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.

| **UNIT-2 : ARTIFICIAL NEURAL NETWORKS** | 9 |
|---|---|

Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory - Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models.

| **UNIT-3 : FUZZY SYSTEMS** | 9 |
|---|---|

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

| **UNIT-4 : GENETIC ALGORITHMS** | 9 |
|---|---|

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion -Mutation Operator - Bit-wise Operators - Convergence of Genetic Algorithm.

| **UNIT-5 : HYBRID SYSTEMS** | 9 |
|---|---|

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy ArtMap: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller.

TOTAL: 45 PERIODS

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

CO1: Apply suitable soft computing techniques for various applications.

CO2: Integrate various soft computing techniques for complex problems.

CO3: Apply soft computing techniques to solve problems

CO4: Learn the Genetic Algorithm

CO5: Create Hybrid Systems using soft computing tools

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | - | 2 | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO2 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | - | 2 | - | - |
| CO3 | 2 | 2 | - | 2 | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO4 | 2 | 2 | - | - | | - | - | - | - | 2 | - | 2 | - | - |
| CO5 | 2 | 2 | 2 | - | 2 | - | - | - | - | 2 | - | 2 | - | - |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.

2.S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt.Ltd., 2nd Edition, 2011.

3.S.Rajasekaran, G.A.VijayalakshmiPai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt.Ltd., 2017.

**REFERENCE BOOKS:**

1.Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, ―Neuro-Fuzzy and Soft Computing‖, Prentice-Hall of India, 2002.

2.KwangH.Lee, ―First course on Fuzzy Theory and Applications‖, Springer, 2005.

3.George J. Klir and Bo Yuan, ―Fuzzy Sets and Fuzzy Logic-Theory and Applications‖, Prentice Hall, 1996.

**WEB RESOURCES:**

1.https://link.springer.com/journal/500/online-first

2.https://cse.iitkgp.ac.in/~dsamanta/courses/sca/index.html

| CS606709 - **TEXT AND SPEECH ANALYSIS** | | | | | |
|---|---|---|---|---|---|
| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To Understand Speech production mechanisms
- To learn Front-end analysis
- To know the language models
- To understand parameter tying
- To classify Phrase-based translation systems

| **UNIT 1:Introduction** | 9 |
|---|---|
| Introduction & Applications. Speech production mechanisms, types of speech sound, source-filter model, applications of speech and text processing | |
| **UNIT-2 : Analysis** | 9 |
| FFT based methods. All-pole filter models, calculation of LP coefficients. LP Spectrum. Cepstral analysis. Front-end analysis for speech recognition (MFCCs). | |
| **UNIT-3 : Language Models** | 9 |
| Perplexity, N-gram language models, discounting, interpolation.Continuous speech recognition. Pruning. Integrating context dependent HMMs and N-gram language models. | |
| **UNIT-4 : Sub-word Acoustic Models** | 9 |
| Large vocabulary speech recogntion, continuous speech training, limitations of word models, context dependent phones, parameter tying, WSJ performance. | |
| **UNIT-5 : SMT - Translation** | 9 |
| Parallel text as training data. Models of word and phrase alignment in translation. Model estimation procedures.Phrase-based translation systems. Implementation via WFSTs | |
| TOTAL: 45 PERIODS | |

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

CO1: Learn the Speech production mechanisms

CO2: Identify Front-end analysis

CO3: Gain the knowledge of language models

CO4: Apply the parameter tying

CO5: classify Phrase-based translation systems

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | - | - | 2 | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO2 | 2 | - | 2 | - | - | - | - | - | - | 2 | - | 2 | - | - |
| CO3 | 2 | - | 2 | 2 | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO4 | 2 | 2 | - | - | - | - | - | - | - | 2 | - | 2 | - | - |
| CO5 | 2 | - | - | 2 | 2 | - | - | - | - | 2 | - | 2 | - | - |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Daniel Jurafsky and James Martin. Speech and Language Processing (Second Edition) , Prentice Hall, 2008

| |
|---|
| 2.Xuedong Huang, Alex Acero and Hsiao-Wuen Hon, Spoken Language Processing, Prentice Hall, 2001 |
| **REFERENCE BOOKS:** |
| 1.Paul Taylor. Test-to_speech Synthesis, Cambridge University Press, 2009 |
| **WEB RESOURCES:** |
| 1.https://azure.microsoft.com/en-us/products/cognitive-services/speech-services |
| 2.https://cloud.google.com/natural-language |

CS606710-**MACHINE LEARNING TECHNIQUES**

| Course Category: Programme Elective | Course Type: Theory | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

COURSE OBJECTIVES:

- To understand the need for machine learning for various problem solving
- To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
- To understand the latest trends in machine learning
- To design appropriate machine learning algorithms for problem solving
- To Analyze and suggest appropriate machine learning approaches for various types of problems

| **UNIT 1:INTRODUCTION** | **9** |
|---|---|
| Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search. | |
| **UNIT-2 : NEURAL NETWORKS AND GENETIC ALGORITHMS** | **9** |
| Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning. | |
| **UNIT-3 : BAYESIAN AND COMPUTATIONAL LEARNING** | **9** |
| Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model. | |
| **UNIT-4 : INSTANT BASED LEARNING** | **9** |
| K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning. | |
| **UNIT-5 : ADVANCED LEARNING** | **9** |
| Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning | |
| TOTAL: 45 PERIODS | |

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

CO1:Differentiate between supervised, unsupervised, semi-supervised machine learning approaches

CO2:Discuss the decision tree algorithm and identity and overcome the problem of overfitting

CO3:Discuss and apply the back propagation algorithm and genetic algorithms to various problems

CO4:Apply the Bayesian concepts to machine learning

CO5:Analyse and suggest appropriate machine learning approaches for various types of problems

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO2 | 2 | 2 | - | 2 | - | - | - | - | - | 2 | - | 2 | - | - |
| CO3 | 2 | 2 | 2 | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO4 | 2 | 2 | - | 2 | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | - | 2 | - | - |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Tom M. Mitchell, ―Machine Learning‖, McGraw-Hill Education (India) Private Limited, 2013.

**REFERENCE BOOKS:**

1.Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning)‖, The MIT Press 2004

2. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective‖, CRC Press, 2009

**WEB RESOURCES:**

1.https://www.analyticsvidhya.com/resources-machine-learning-deep-learning-neural-networks/

2.https://www.kdnuggets.com/2018/12/finlayson-machine-learning-resources.html

# INSTITUTE ELECTIVE

| CS607106 - **Augmented Reality / Virtual Reality** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Institute Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **2** | **0** | **2** | **3** |
| **COURSE OBJECTIVES:** | | | | | |
| • Learn the fundamental Computer Vision, Computer Graphics and Human-Computer interaction Techniques related to VR/AR<br>• Review the Geometric Modeling Techniques | | | | | |

- Review the Virtual Environment
- Discuss and Examine VR/AR Technologies
- Use of various types of Hardware and Software in Virtual Reality systems

| | |
|---|---|
| **UNIT 1: Introduction to Virtual Reality(VR)** | **9** |
| Virtual Reality and Virtual Environment, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark. | |
| **UNIT 2: Computer Graphics and Geometric Modelling** | **9** |
| Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, Color theory, Conversion From 2D to3D, 3D space curves, 3D boundary representation, Simple 3D modelling, 3D clipping, Illumination models, Reflection models, Shading algorithms, Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection. | |
| **UNIT 3: Virtual Environment** | **9** |
| **Input / Output Devices:** Input (Tracker, Sensor, Digital Gloves, Movement Capture, Video-based Input, 3DMenus & 3DScanner,etc.), Output (Visual/ Auditory/ Haptic Devices)<br>**Generic VR system:** Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems, Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object in between, free from deformation, particle system. | |
| **UNIT 4: Augmented Reality(AR)** | **9** |
| Taxonomy, Technology and Features of Augmented Reality, AR Vs VR, Challenges with R, AR systems and functionality, Augmented Reality Methods, Visualization Techniques for Augmented Reality, Enhancing interactivity in AR Environments, Evaluating AR systems. | |
| **UNIT 5: Development Tools and Frameworks** | **9** |
| Human factors: Introduction, the eye, the ear, the somatic senses Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems Software: Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML. | |
| **TOTAL: 45 PERIODS** | |

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

CO1: Learn about the fundamental computer vision, Computer graphics and human-Computer interaction techniques .

CO2: Study about the geometric modeling techniques.

CO3: Learn the importance of Virtual Environment.

CO4: Analyze And evaluate VR/AR technologies.

CO5: Apply various types of Hardware and software in virtual reality systems.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | | | | | | | | 2 | | | | |
| CO2 | | | 2 | | | | | | | | | | | |
| CO3 | | 3 | | | | | | | | | | | | |
| CO4 | | | | 2 | | | | | | 2 | | | | |
| CO5 | | | | | 3 | | | | | | | 2 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**


1 Coiffet, P., Burdea, G. C., (2003), "Virtual Reality Technology," Wiley-IEEE Press

2.Schmalstieg, D., Höllerer, T., (2016), "Augmented Reality: Principles & Practice,"

3.Norman, K., Kirakowski, J.,(2018), " Wiley Handbook of Human Computer Interaction,"Wiley-Blackwell..

4.LaViola Jr., J. J., Kruijff, E., McMahan, R. P., Bowman, D. A., Poupyrev, I., (2017), "3D UserInterfaces:Theoryand Practice,"Pearson


**REFERENCE BOOKS:**


1.Fowler, A., (2019), "Beginning iOS AR Game Development: Developing Augmented Reality Apps with Unity and C#," Apress

2.Hassanien, A. E., Gupta, D., Khanna, A., Slowik, A., (2022), "Virtual and Augmented Reality for Automobile Industry: Innovation Vision and Applications,"Springer

3.Paul Mealy, "Virtual & Augmented Reality for Dummies", 2018 edition.


**WEB RESOURCES:**

1.https://www.vntana.com/blog/web-ar/

2.https://webflow.com/made-in-webflow/augmented-reality

CS607107 - **ROBOTIC PROCESS AUTOMATION**

| Course Category:**Institute Elective** | Course Type: Theory | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

COURSE OBJECTIVES:

- To develop a knowledge in basics of robotics.
- To understand the basic homogeneous transformation matrices
- To study the forward and inverse kinematics.
- To know the various sensors and actuators
- To know the velocity and force feedback

| **UNIT 1:ROBOT FUNDAMENTALS** | 9 |
|---|---|

Classification of Robots - History of Robotics - Robot Components - Robot Joints and Degrees of Freedom –Coordinates and Reference Frames - Robot Workspace – Applications - Social Issues.

| **UNIT-2 : RIGID MOTIONS AND HOMOGENEOUS TRANSFORMATIONS** | 9 |
|---|---|

Representation of Positions and rotations in matrix form - Rotational Transformations - Rotation with respect to thecurrent coordinate frame - Rotation with respect to a fixed frame - Parameterizations of Rotations - Euler Angles -Roll, Pitch, Yaw Angles - Axis/Angle Representation - Homogeneous Transformations.

| **UNIT-3 : FORWARD AND INVERSE KINEMATICS** | 9 |
|---|---|

Forward Kinematics - Kinematic Chains - Denavit Hartenberg Representation - Existence and uniqueness issues -Assigning the coordinate frames -Inverse Kinematics - Kinematic Decoupling - Inverse Position - Inverse Orientation -Degeneracy and Dexterity.

| **UNIT-4 : ROBOTIC SENSORS AND ACTUATORS** | 9 |
|---|---|

Sensor Characteristics – Position, Velocity, Acceleration Sensors - Force and Pressure Sensors - Torque Sensors -isible Light and Infrared Sensors - Touch and Tactile Sensors - Proximity Sensors - Range Finders – other sensorsCharacteristics of Actuating Systems - Comparison of Actuating Systems - Hydraulic Actuators - Pneumatic Devices -Electric Motors and their types.

| **UNIT-5 : MOTIONS AND VELOCITIES** | 9 |
|---|---|

Differential Motions and Velocities - Differential Relationships – Jacobian - Differential Motions of a Frame -Calculation of the Jacobian - Inverse Jacobian – Force feedback (elementary) – end effector systems – case study
with egg picker.

**TOTAL: 45 PERIODS**

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

CO1: Understand the fundamentals of robotics.

CO2: Explain about rigid body transformations.

CO3: Describe the forward and inverse kinematics.

CO4: Explain about various robotic sensors and actuators.

CO5: Illustrate end effector motion with an example.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | - | 2 | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO2 | 2 | 2 | 2 | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO3 | 2 | 2 | 2 | 2 | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO4 | 2 | 2 | - | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO5 | 2 | 2 | 2 | 2 | 2 | - | - | - | - | 2 | - | 2 | - | - |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Saeed Benjamin Niku," Introduction To Robotics: Analysis, Control, Applications", John Wiley & sons, 2011

2.Mark W. Spong," Robot Dynamics and Control", Wiley,2005

**REFERENCE BOOKS:**

1.Paul Sandin ,"Robot mechanisms and mechanical devices illustrated", McGraw-Hill, 2003

2.Jorge Angeles, "Fundamentals of Robotic Mechanical Systems: Theory, Methods, and Algorithms", SpringerInternational, 2014

**WEB RESOURCES:**

1.https://www.uipath.com/rpa/robotic-process-automation

2.https://techbeacon.com/enterprise-it/15-essential-resources-robotic-process-automation-teams

| CS607205 - **NEURAL NETWORKS AND DEEP LEARNING** | | | | | |
|---|---|---|---|---|---|
| Course Category: **Institute Elective** | Course Type: Theory | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To learn basic concepts of machine learning
- To understand descriptive statistics
- To explore regression and classification models
- To learn unsupervised learning techniques
- To study concepts of artificial neural networks

| **UNIT 1:INTRODUCTION TO MACHINE LEARNING** | 9 |
|---|---|

Concept of learning-Types of machine learning-Industrial applications-Introduction to R-Object, Vector, List, Factor,Matrix, Array, Data Frame, Manipulating objects, Input/output.

| **UNIT-2 : DESCRIPTIVE STATISTIC** | 9 |
|---|---|

Central tendency- Dispersion of data-Variance and standard deviation-Shape-skewness, kurtosis, percentiles, fivenumber summary, boxplots, histograms, barplot, pie chart, scatter plot , covariance, correlation, Chi-square test fortwo way tables.

| **UNIT-3 : REGRESSION AND CLASSIFICATION** | 9 |
|---|---|

Regression- Simple linear regression-Multiple linear regression-Logistic regression-Classification-Decision tree-knearestneighbours-Support vector machine.

| **UNIT-4 : UNSUPERVISED LEARNING** | 9 |
|---|---|

Clustering-Applications-Similarity measures-Partition based clustering techniques- K means clustering, k-mediodclustering- Hierarchical clustering-Density based clustering-Cluster validation

| **UNIT-5 : NEURAL NETWORKS AND DEEP LEARNING** | 9 |
|---|---|

Neural networks basics-Activation functions, learning rate, stochastic gradient descent- Deep Feed forwardnetworks- Convolutional Networks-Autoencoders- Undercomplete, Regularized and Denoising Autoencoders.

**TOTAL: 45 PERIODS**

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

CO1: Exploit the basics of machine learning

CO2: Work with descriptive statistics

CO3: Apply regression and classification for real world problems

CO4: Work with unsupervised learning methods

CO5: Construct neural network architecture for real world problem

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | - | 2 | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO2 | 1 | 2 | - | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO3 | 1 | 2 | 2 | 2 | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO4 | 1 | 2 | - | - | 2 | - | - | - | - | 2 | - | 2 | - | - |
| CO5 | 2 | 2 | 2 | 2 | 2 | - | - | - | - | 2 | - | 2 | - | - |

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

| |
|---|
| 1.Nina Zumel, John Mount, “Practical Data Science with R”, Manning Publications, 2014 |
| 2.Jiawei Han, Micheline Kamber, Jian Pei, “Data Mining : Concepts and Techniques”, Morgan Kaufmann<br>Publishers, Third Edition,2014 |
| **REFERENCE BOOKS:** |
| 1.Gareth James, Daniela Witten, Trever Hastie and Robert Tibshirani, “An Introduction to Statistical Learning:with Applications in R”, Springer, 2015 |
| 2.P. Flach, “Machine Learning: The art and science of algorithms that make sense of data”, Cambridge UniversityPress, 2012. |
| **WEB RESOURCES:** |
| 1.https://www.coursera.org/learn/neural-networks-deep-learning |
| 2.https://www.analyticsvidhya.com/blog/2015/11/free-resources-beginners-deep-learning-neural-network/ |

| CS607206 - **Cyber security** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Institute Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To familiarize various types of cyber-attacks and cyber-crimes
- To give an overview of the cyber laws
- To study the defensive techniques against these attacks
- To study cyber security challenges and implications.
- To know about Cyber Security.

**UNIT 1: Introduction** **9**

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

**UNIT 2: Cyber Security** **9**

Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing..

**UNIT 3: Cybercrime** **9**

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops

**UNIT 4: IPR in Cyber Security** **9**

Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations. Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

**UNIT 5:Privacy Issues** **9**

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc. Cybercrime: Examples and Mini-Cases Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances. Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain

**TOTAL: 45 PERIODS**

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

CO1: Able to learn the basic concepts of Cyber Crimes.

CO2: Ability to identify the attacks in Cyber Crimes

CO3: Able to specify the suitable methods used in Cyber Crime

CO4: Ability to face cyber security challenges.

CO5: Able to study the Cyber laws.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | | | | | | | | | | 1 | | |
| CO2 | | 2 | | | | | | | | | | 2 | | |
| CO3 | | | | 2 | | | | | | | | | | |
| CO4 | | | | 2 | | | | | | | | | | |
| CO5 | | 1 | | | | | | | | | | 2 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley.

2.B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

3.Jon Errickson, "Hacking, The Art of Exploitation", 2008.

**REFERENCE BOOKS:**

1.Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press

2.Introduction to Cyber Security , Chwan-Hwa(john) Wu,J.David Irwin.CRC Press T&F Group

3. Kent Peterson, "Cyber Security, Cyberwar and Cyber Weapn", 2021.

**WEB RESOURCES:**

1.https://www.cybersecurityeducation.org/resources/

2.https://www.w3schools.com/cybersecurity/

CS607305 - **Front End Development**

| **Course Category: Institute Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To understand basic concept of html
- To Learn the Css properties
- To create the Css queries
- To understand the javascript functions
- To implement the real time projects.

**UNIT 1: Introduction** **9**

Introduction to Front-End Development- Code Editor Installation- Html 5 Introduction- Html 5 Basic Tags- Html 5 Tags- Html 5 Semantic Tags.

**UNIT 2: CSS** **9**

Task Solving & Doubts Clearing on Html 5- Css Introduction- Css Basic Properties- Css Box Model Concepts- Css Properties

**UNIT 3: Animation** **9**

Css Media Queries (Responsive Site)- Css Tasks- Css Animation- Javascript Introduction- Javascript Basics.

**UNIT 4: Java script** **9**

Javascript Functions- Javascript DOM- Bootstrap Introduction- Bootstrap Exploration- Bootstrap Components- Bootstrap Real Time Implementation.

**UNIT 5:Project work** **9**

Practical Portfolio Building- Wrapping Up Front-End Development

**TOTAL: 45 PERIODS**

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

CO1: Learn the basic concept of html..

CO2: Study about the CSS properties.

CO3: Analyze about the CSS queries.

CO4: Study about the javascript functions.

CO5: Implement the real time projects.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 2 | | | | | | | | | 1 | 2 | | |
| CO2 | | | 2 | | | | | 2 | | | 2 | | | |
| CO3 | | | 2 | | | | | | | 1 | | 2 | | |
| CO4 | | 1 | | | | | | | | | | | | |
| CO5 | | | 2 | | | | | | | | 3 | 2 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1Jon Duckett, "HTML & CSS, Design and Build Web", 2011.

2. Jon Duckett, "Java Script and JQuery: Front End Development", 2018.

3. Jennifer Robins, "Beginner's guide to HTML, CSS, JavaScript, And Web Graphics", Fifth Edition , 2018.

**REFERENCE BOOKS:**

| |
|---|
| 1.Mariin, Haverbeke, "Eloquent Javascript", 3rd Edition, 2018. |
| 2.Mark Sapp, "Front-end Web Developer:Javascript,HTML5 and CSS3", 2018. |
| 3.Chris Aquino, Todd Gandee, "Front-end Development", 2016. |
| **WEB RESOURCES:** |
| 1.https://www.pluralsight.com/blog/software-development/tips-for-front-end-developers |
| 2.https://w3resource.com/ |

| CS607306 - **Block Chain Architecture** | | | | | | |
|---|---|---|---|---|---|---|
| **Course Category: Institute Elective** | **Course Type: Theory** | **L** | **T** | **P** | | **C** |
| | | **3** | **0** | **0** | | **3** |
| **COURSE OBJECTIVES:** | | | | | | |

- To introduce the concept of Blockchain .
- To study the Blockchain architecture
- To learn the process of Bitcoin mining and Ethereum platform for developing smart contracts.
- To identify applications of Blockchain in various sectors

| **UNIT 1: INTRODUCTION TO BLOCKCHAIN** | **9** |
|---|---|
| Introduction to Block chain: Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. Block chain Architecture and Design: Basic crypto primitives: Hash, Signature,) Hash chain to Block chain, Basic consensus mechanisms. | |
| **UNIT 2: BLOCKCHAIN ARCHITECTURE** | **9** |
| Structure of a Block–Block Header – Block Identifiers – The Genesis Block – Linking Blocks in the Blockchain – Merkle Trees – Properties of Blockchain Solutions – Blockchain Transactions – Permissionless Blockchain – Distributed Consensus Mechanisms: Proof of Work, Proof of Stake, Proof of Burn, Proof of Elapsed Time (PoET) – Permissioned Blockchain – Permissioned Consensus Mechanisms: Practical Byzantine Fault Tolerant Algorithm (PBFT). | |
| **UNIT 3: HYPERLEDGER FABRIC & GAME THEORY** | **9** |
| Hyperledger Fabric (A): Decomposing the consensus process, Hyperledger fabric components, Chain code Design and Implementation - Hyperledger Fabric (B): Beyond Chaincode: fabric SDK and Front End (b) Hyperledger composer tool - Game Theory: Introduction to Game Theory, Nash Equilibrium, Prisoner's Dilemma, Byzantine Generals' Problem, Zero-Sum Games. | |
| **UNIT 4: BITCOIN MINING AND ETHEREUM PLATFORM** | **9** |
| Bitcoin Economics and Currency Creation – Independent Verification of Transactions – Mining Nodes – Aggregating Transactions into Blocks – Constructing the Block Header – Mining the Block – Validating a New Block – Assembling and Selecting Chains of Blocks – Mining and the Hashing Race Ethereum: Design Philosophy – Ethereum Blockchain – Ethereum Smart Contracts – Ethereum Virtual Machine and Code Execution – Introduction to Decentralized Apps (DApps). | |
| **UNIT 5:BLOCKCHAIN APPLICATIONS** | **9** |
| Blockchain for Government - Digital identity, land records and other kinds of record keeping between government entities - public distribution system social welfare systems - Blockchain Cryptography, Privacy and Security on Blockchain | |
| **TOTAL: 45 PERIODS** | |

| **COURSE OUTCOMES:** At the end of the course, the student will be able to |
|---|
| CO1: Identify the features of Blockchain. |
| CO2: Design a Blockchain architecture for simple case. |
| CO3: Hyperledger Fabric &Game theory algorithms. |

CO4: Mine bitcoin and develop smart contracts using Ethereum platform.

CO5: Apply Blockchain technology to solve practical issues in various sectors.

**CO-PO MAPPING**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 2 | | | | | | | | | | 2 | | |
| CO2 | | | 3 | | | | | 2 | | | | | | |
| CO3 | | 2 | | | | | | | | | | 2 | | |
| CO4 | | | | 1 | | | | | | | | | | |
| CO5 | | | | | | 2 | | | | | | 2 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos.

2.Blockchain by Melanie Swa, O'Reilly.

3.Hyperledger Fabric – https://www.hyperledger.org/projects/fabric.

4.Zero to Blockchain – An IBM Redbooks course, by Bob Dill, David Smits.

**REFERENCE BOOKS:**

1.Andreas M. Antonopoulos," The Internet of Money", O'Reilly Media, Inc., 2017.

2.Chris Dannen, "Introducing Ethereum and Solidity: Foundations of Cryptocurrency and Blockchain.

3.Nicolas Dorier, "Blockchain Programming in C#", Open License, 2017

**Web Resources:**

1.https://www.ibm.com/topics/blockchain

2.https://www.simplilearn.com/tutorials/blockchain-tutorial/blockchain-technology

| CS607307 - **Optimization Techniques** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Institute Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **COURSE OBJECTIVES:** | | | | | |

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

| **UNIT 1: DEVELOPMENT OF O.RANDALLOCATION** | **9** |
|---|---|

Development, definition, characteristics and phases, types of operation research models, applications; Allocation: linear programming, problem formulation, graphical solution, simplex method, artificial variables techniques, two–phase method, big-M method.

| **UNIT 2: TRANSPORTATION AND ASSIGNMENT PROBLEM** | **9** |
|---|---|

Transportation problem: Formulation, optimal solution, unbalanced transportation problem, Degeneracy; Assignment problem, formulation, optimal solution, variants of assignment problem, traveling salesman problem.

| **UNIT 3: SEQUENCINGANDREPLACEMENT** | **9** |
|---|---|

Sequencing: Introduction, flow, shop sequencing, njobs through two machines, njobs through three machines, job shop sequencing, and two jobs through "m" machines. Replacement: Introduction: Replacement of items that deteriorate with time, when money value is not counted and counted, replacement of items that fail completely, group replacement.

| **UNIT 4: THEORYOFGAMESANDINVENTORY** | **9** |
|---|---|

Theory Of Games: Introduction–Terminology, Solution of games with saddle points and without saddle points, 2×2games, dominance principle, mX 2 &2Xngames, Graphical method. Inventory: Introduction**,** Single item**,** Deterministic models**,** Purchase inventory models with one price break and multiple price breaks, Stochastic models, demand may be discrete variable or continuous variable, Single period model and no setupcost.

| **UNIT 5:WAITINGLINES, DYNAMIC PROGRAMMIMG AND SIMULATION** | **9** |
|---|---|

Waiting Lines: Introduction, Terminology, Single Channel, Poisson arrivals and exponential service times with infinite population and finite population models, Multichannel, Poisson arrivals and exponential service times within finite population. Dynamic Programming: Introduction, Terminology, Bellman"s Principle of optimality, Applications of dynamic programming, shortest path problem, linear programming problem. Simulation: Introduction, Definition, types of simulation models, steps involved in the simulation process-Advantages and Disadvantages, Application of Simulation to queuing and inventory.

**TOTAL: 45 PERIODS**

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

CO1: Recall the theoretical foundations of various issues related to linear programming modeling to formulate real-world problems as a LP model

CO2:To know the theoretical workings of the graphical, simplex and analytical methods for making effective decision on variables so as to optimize the objective function.

CO3:Identify appropriate optimization method to solve complex problems involved in various industries..

CO4: To learn about the theory of games and inventory.

CO5: To study the appropriate algorithm for allocation of resources to optimize the process of assignment.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 2 | | | | | | | | 2 | | 2 | | |
| CO2 | | | 2 | | | | | 2 | | | | | | |
| CO3 | | 1 | | | | | | | | | | 2 | | |
| CO4 | | | | | | 3 | | | | 2 | | | | |
| CO5 | | | 2 | | | | | | | | | 2 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.J. K. Sharma, "Operations Research", Macmillan, 5th Edition, 2012. .

2.R. Pannerselvan, "Operations Research.", 2nd Edition, PHI Publications, 2006.

3.Fredrick S Hillier, Gerald J Lieberman, ""Introduction to operation Research", 2005

**REFERENCE BOOKS:**

1.A. M. Natarajan, P. Balasubramani, A. Tamilarasi, "Operations Research"Pearson Education, 2013.

2.Maurice Saseini, Arhur Yaspan, Lawrence Friedman, "Operations Research: Methods & Problems", 1 st Edition, 1959.

3.Pelin G Cambolat, "Introduction to operation Research", 2015.

**WEB RESOURCES:**

1. https://www.hotjar.com/website-optimization/techniques/

2.https://www.searchenginejournal.com/website-optimization-essentials/280641/

| CS607404 - **Decision Making Methods** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Institute Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **COURSE OBJECTIVES:** | | | | | |

- To understand system view approach creation of various aspects of the structure, management and decision-making of the modern organization at all its levels;
- To acquire the skills of analytical and empirical research of existing organization and decision making processes, development and justification of organization's improvement;
- To develop decision-making process about the essence of strategies process for the modern organization as a whole and its individual units;
- To develop skills for quantitative and qualitative decision-making methods for organization of management at both micro and macro levels with the identification of short-term and long-term consequences of these decisions.

| **UNIT 1: Introduction** | **9** |
|---|---|
| Problem Solving and Decision Making-Definition of the problem and potential causes for the problem-Identifying alternatives for approaches to resolve the problem-Selecting an approach to resolve the problem-Implementation of the best alternative-Action plan-Monitoring implementation of the plan-Rational Versus Organic Approach to Problem Solving-Discover Your Decision Making Style. | |
| **UNIT 2: Decision Making Process** | **9** |
| Decision Making Process-Disciplined decision-making process-Formal decision making method-Time decisions-Problem definition-Requirements identification-Goal establishment.-Evaluation criteria development-General Decision–Making Process (scheme)-Paired Comparison Analysis. | |
| **UNIT 3: Analytic Hierarchy** | **9** |
| Decision Making Process-General Decision–Making Process (description)-Define the Problem.-Determine Requirements-Establish Goals-Identify Alternatives-Define Criteria-Select a Decision-Making Tool: Pros and Cons Analysis, Kepner-Tregoe Decision Analysis (K-T), Analytic Hierarchy Process (AHP), Multi-Attribute Utility Theory Analysis (MAUT), Cost Benefit Analysis (CBA), Custom Tailored Tools etc-Evaluate Alternatives against Criteria-Validate Solution(s) against Problem Statement. | |
| **UNIT 4: Analysis techniques** | **9** |
| Decision Making Methods-Decision Analysis techniques-Pros and Cons Analysis-Pros and Cons Analysis (example)-Kepner-Tregoe (K-T) Decision Analysis-Kepner-Tregoe (K-T) Decision Analysis (example)-K-T Troubleshooting Methodology-Determining pros and cons of franchising by using SWOT-analysis. | |
| **UNIT 5:Analytic Hierarchy Process** | **9** |
| Decision Making Methods-Analytic Hierarchy Process (AHP)-Pair-wise comparisons-Analytic Hierarchy Process (AHP) (example)-Example of Pair-Wise Comparison of Criteria. | |
| **TOTAL: 45 PERIODS** | |

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

CO1:To study the system view approach creation of various aspects of the structure.

CO2:Acquire the skills of analytical and empirical research of existing organization and decision making processes.

CO3:Develop decision-making process about the essence of strategies process.

CO4:Develop skills for quantitative and qualitative decision-making methods for organization of the management.

CO5:To learn the research and manage business processes, to prepare analytical materials based on the results of their application..

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 2 | | | | | 2 | | | | |
| CO2 | | | | 1 | | | | 2 | | | | 2 | | |
| CO3 | | 1 | 2 | | | | | | | | | 2 | | |
| CO4 | | | 3 | | | | | | | 2 | | | | |
| CO5 | | | | | 2 | | | | | 1 | | | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Engineering Decision Making and Risk Management, Jeffrey W. Herrmann, ISBN: 978-1-118-91933-0 April 2015

2.Decision-Making in Engineering Design: Theory and Practice (Decision Engineering), by K. Iino (Translator), Yotaro Hatamura (Editor).

3.Malcom Gladwell, "Power of good thinking and bad thining", 2009 edition

**REFERENCE BOOKS:**

1.Decision-making, by Shyama Prasad Mukherjee, 2022.

2.Thomas Richards, "Problem solving:Best strategies to Decision making", 2015 edition.

3.Jhon C Maxwell, "How successful people thinking:Change thinking, change your life", 2009.

**WEB RESOURCES:**

1.https://www.mindtools.com/cyz4vzu/decision-making

2.https://www.smashingmagazine.com/2010/06/decision-making-models-in-web-development/

| CS607405 - **Web Design And Development** | | | | | |
|---|---|---|---|---|---|
| **Course Category: Institute Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **COURSE OBJECTIVES:** | | | | | |
| • To Learn the basic concepts in HTML, CSS, Java script<br>• To Understand the responsive design and development<br>• To learn the web project management and maintenance process<br>• To Design a Website with HTML, JS, CSS / CMS – Word press. | | | | | |
| **UNIT 1: INTRODUCTION : MARKUP WITH HTML** | | | | | **9** |
| Introduction-Document background color and image – Text Structuring –Character Formatting – Lists – Ordered – Unordered – Definition Lists – Links to a web page – Tables – Borders and Rules – Rows and Cells – Formatting with Tables –Form handling-Building Forms-HTML5. | | | | | |
| **UNIT 2: PHP INTRODUCTION** | | | | | **9** |
| Incorporating PHP Within HTML-The Structure of PHP -Expressions and Control Flow in PHP-Operators-Conditionals. | | | | | |
| **UNIT 3: PRESENTATION WITH CSS** | | | | | **9** |
| Introduction to CSS- Importing a Style Sheet –CSS Rules-Style Types-CSS Selectors -The CSS Cascade - Measurements - Fonts and Typography -Managing Text Styles -CSS Colors - Positioning Elements –Pseudo-classes- The Box Model and Layout -Advanced CSS with CSS3- Attribute Selectors -CSS3 Backgrounds - CSS3 Borders –Text Effects Transformations. | | | | | |
| **UNIT 4: JAVASCRIPT INTRODUCTION** | | | | | **9** |
| Exploring JavaScript-Using Comments-Semicolons-Variables-Operators-Variable Typing-Functions - Global VariablesLocal Variables-The Document Object Model-Expressions and Control Flow in JavaScript-Expressions-Literals and Variables- Operators -The with Statement -Using try ... catch -Conditionals -Looping - JavaScript Arrays -JavaScript and PHP Validation and Error Handling-Validating User Input with JavaScript-Regular Expressions -Redisplaying a Form After PHP Validation. | | | | | |
| **UNIT 5:MYSQL AND AJAX** | | | | | **9** |
| Accessing MySQL Using PHP- Querying a MySQL Database with PHP -A Practical Example -Practical MySQL - Performing Additional Queries-Preventing SQL Injection - HTML Injection -Using Ajax- Using XML Http Request | | | | | |
| **TOTAL: 45 PERIODS** | | | | | |
| **COURSE OUTCOMES:** At the end of the course, the student will be able to | | | | | |
| CO1: Study about the basics of website and html. | | | | | |
| CO2:Know about the architecture of web framework. | | | | | |
| CO3: Design interactive web pages using Scripting languages. | | | | | |
| CO4: Learn about the Python web frame work technologies. | | | | | |
| CO5: Design and develop a Web site using HTML, JS, CSS/ CMS- Wordpress. | | | | | |
| | | | | | |
| **CO-PO MAPPING** | | | | | |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 2 | | | | | | | | | | 2 | | |
| CO2 | | | 3 | | | | | 2 | | | | | | |
| CO3 | | | 2 | | | | | | | 2 | | 2 | | |
| CO4 | | 2 | | | | | | | | | | | | |
| CO5 | | | 2 | | | | | | | 2 | | 2 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1.Steven M.Schafer, " HTML, XHTML and CSS", Wiley Publishing, Inc., Fifth edition 2010.

2.Nixon Robin "Learning PHP, MySQL, JavaScript, CSS & HTML5 A step- by-step guide to creating Dynamic Websites" , O'Reilly Media, Inc, USA,June 2014..

3.Jeffrey C.Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006 4. Thomas Powell,"HTML & CSS: The Complete Reference", McGraw Hill, Fifth Edition, Mar 2010

**REFERENCE BOOKS:**

1.Chuck Musciano Bill Kennedy, "HTML & XHTML: The Definitive Guide", O'Reilly, 6th Edition, October 24, 2006.

2.Thomas A. Powell, "Web Design: The Complete Reference", McGraw Hill, June 2000 .

3.Jeffrey C.Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006 4. Thomas Powell,"HTML & CSS: The Complete Reference", McGraw Hill, Fifth Edition, Mar 2010.

**WEB RESOURCES:**

1.https://homepages.cwi.nl/~steven/www/web-resources.html

2.https://www.tutorialspoint.com/xhtml/xhtml_useful_resources.html

CS607406 - **JAVA PROGRAMMING**

| **Course Category: Institute Elective** | **Course Type: Theory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To learn about Java features
- To understand Object Oriented Programming concepts and basic characteristics of Java.
- To know the basic principles of inheritance and interfaces.
- To develop Java applications with threads and package.
- To define exceptions and use I/O streams

| **UNIT 1: INTRODUCTION** | **9** |
|---|---|
| Fundamentals of Object-Oriented Programming - Java Features – Difference between Java and C-Java Environment- Overview of Java Language: Introduction-Simple Java Program - Java Program Structure – Java Tokens – Java statements – ImplementingaJavaprogram– JavaVirtualMachine–Commandlinearguments–Constants,variablesandDataTypes– OperatorsandExpressions–BranchingandLooping. | |
| **UNIT 2: BASIC CONSTRUCTS** | **9** |
| Class: Introduction – Defining a Class – Fields Declaration – Methods Declaration – Creating Objects – Accessing Class Members – Constructors – Method Overloading –Static Members–Nesting of Methods–Arrays, Strings and Vectors: Introduction–One- Dimensional Arrays– Creating an Array–Two-Dimensional Arrays –Strings.. | |
| **UNIT 3: INHERITANCE AND INTERFACES** | **9** |
| Extending a class – Overriding methods – Final Variables and Methods –Final Classes – Finalizer Methods – Abstract Methods and Classes – Visibility Control - Interfaces:MultipleInheritance:Introduction–DefiningInterfaces–Extending Interfaces– Implementing Interfaces–Accessing Interface Variables. | |
| **UNIT 4: PACKAGES AND MULTI THREADING** | **9** |
| **Packages**: – Java API Packages – Using System Packages – Naming Conventions –Creating Packages – Accessing a Package – Using a Package – Adding a Class to a Package – Hiding Classes - Multithreaded Programming: Introduction – Life Cycle of a Thread—Creating Threads– Extending the Thread Class- Implementing the 'Runnable' Interface - Stopping and Blocking a Thread—Using Thread Methods. | |
| **UNIT 5:EXCEPTIONANDI/OHANDLING** | **9** |
| Exception Handling: Introduction – Types of Errors – Exceptions – Syntax of Exception Handling Code – Multiple Catch Statements – Using Finally Statement – Throwing Our Own Exceptions - Input/output: Introduction – Concept of Streams – Stream Classes –Byte Stream Classes–Character Stream Classes– Handling Primitive Data Types- Simple input and output. | |
| **TOTAL: 45 PERIODS** | |

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

CO1: Able to implement, compile,testandrunJavaprogram

CO2: Develop Java programs using OOP principles.

CO3: Develop Java programs implementing the concepts of inheritance and interfaces.

CO4: Develop multi-threaded and package Java applications.

CO5: Build Java applications with exception handling and using I/O streams.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 2 | | | | | | | | | | | | |
| CO2 | | | 1 | | | | | | | | | 1 | | |
| CO3 | | | 2 | | | | | | | 2 | | 2 | | |
| CO4 | | | | 2 | | | | | | | | | | |
| CO5 | | | | | 2 | | | | | 2 | | 2 | | |

**1- low, 2 - medium, 3 - high, '-' no correlation**

**TEXT BOOKS:**

1. E.Balagurusamy, "Programming with Java: APrimer",FourthEdition, First reprint, TataMcGraw Hill,Reprint2011.

2.Herbet Schildt, " Java: A beginners guide", Eight Edition.

3.Bloch Jhosua, "Effective Java, A programming Language guide", 2nd Edition

**REFERENCE BOOKS:**

1.HerbertSchildt, "Java: A Beginner's Guide",4thEdition,TataMcGrawHill,2007.

2.C.Xavier,"Java Programming: A Practical Approach", TataMcGrawHill, 2011.

3.PaulDeitel&HarveyDeitel, "Java How to Program", Eleventh Edition, Pearson Education Ltd.2017.

**WEB RESOURCES:**

1.https://www.iitk.ac.in/esc101/05Aug/tutorial/information/resources.html

2.https://www.simplilearn.com/resources-to-learn-java-programming-article