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| B.sc,  internet of things |
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| **SYLLABUS** |
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| **from the academic year**  **2023 – 2024** |
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| **TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION, CHENNAI – 600 005** |
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**1. Introduction**

**B.Sc. Internet of Things**

Education is the key to development of any society. Role of higher education is crucial for securing right kind of employment and also to pursue further studies in best available world class institutes elsewhere within and outside India. Quality education in general and higher education in particular deserves high priority to enable the young and future generation of students to acquire skill, training and knowledge in order to enhance their thinking, creativity, comprehension and application abilities and prepare them to compete, succeed and excel globally. Learning Outcomes-based Curriculum Framework (LOCF) which makes it student-centric, interactive and outcome-oriented with well-defined aims, objectives and goals to achieve. LOCF also aims at ensuring uniform education standard and content delivery across the state which will help the students to ensure similar quality of education irrespective of the institute and location.

Computer Science is the study of quantity, structure, space and change, focusing on problem solving, application development with wider scope of application in science, engineering, technology, social sciences etc. throughout the world in last couple of decades and it has carved out a space for itself like any other disciplines of basic science and engineering. Computer science is a discipline that spans theory and practice and it requires thinking both in abstract terms and in concrete terms. Nowadays, practically everyone is a computer user, and many people are even computer programmers. Computer Science can be seen on a higher level, as a science of problem solving and problem solving requires precision, creativity, and careful reasoning. The ever-evolving discipline of computer science also has strong connections to other disciplines. Many problems in science, engineering, health care, business, and other areas can be solved effectively with computers, but finding a solution requires both computer science expertise and knowledge of the particular application domain. Computer science has a wide range of specialties. These include Computer Architecture, Software Systems, Graphics, Artificial Intelligence, Computational Science, and Software Engineering. Drawing from a common core of computer science knowledge, each specialty area focuses on specific challenges. Computer Science is practiced by mathematicians, scientists and engineers. Mathematics, the origins of Computer Science, provides reason and logic. Science provides the methodology for learning and refinement. Engineering provides the techniques for building hardware and software.

The Students completing this programme will be able to present Software application clearly and precisely, make abstract ideas precise by formulating them in the Computer languages. Completion of this programme will also enable the learners to join teaching profession, enhance their employability for government jobs, jobs in software industry, banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

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| **LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME** | | |
| **Programme:** | **B.Sc., Internet of Things** | |
| **Programme Code:** |  | |
| **Duration:** | **3 years [UG]** | |
| **Programme Outcomes:** | **PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study  **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one’s views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.  **PO3: Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.  **PO4: Problem solving: Capacity** to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one’s learning to real life situations.  **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.  **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation  **PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team  **PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.  **PO9: Reflective thinking**: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.  **PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.  **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.  **PO 12 Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.  **PO 13: Moral and ethical awareness/reasoning**: Ability to embrace moral/ethical values in conducting one’s life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demon starting the ability to identify ethical issues related to one‟s work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.  **PO 14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.  **PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including „learning how to learn‟, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling. | |
| **Programme Specific Outcomes:** | | **PSO1**: To enable students to apply basic microeconomic, macroeconomic and monetary concepts and theories in real life and decision making.  **PSO 2**: To sensitize students to various economic issues related to Development, Growth, International Economics, Sustainable Development and Environment.  **PSO 3**: To familiarize students to the concepts and theories related to Finance, Investments and Modern Marketing.  **PSO 4**: Evaluate various social and economic problems in the society and develop answer to the problems as global citizens.  **PSO 5:** Enhance skills of analytical and critical thinking to analyze effectiveness of economic policies. | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** |
| **PSO 1** | Y | Y | Y | Y | Y | Y | Y | Y |
| **PSO 2** | Y | Y | Y | Y | Y | Y | Y | Y |
| **PSO3** | Y | Y | Y | Y | Y | Y | Y | Y |
| **PSO 4** | Y | Y | Y | Y | Y | Y | Y | Y |
| **PSO 5** | Y | Y | Y | Y | Y | Y | Y | Y |

**3 – Strong, 2- Medium, 1- Low**

**Highlights of the Revamped Curriculum**:

* Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
* The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising mathematical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced mathematical topics in the final semester, catering to the needs of stakeholders with research aptitude.
* The General Studies and Mathematics based problem solving skills are included as mandatory components in the ‘Training for Competitive Examinations’ course at the final semester, a first of its kind.
* The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
* The Industrial Statistics course is newly introduced in the fourth semester, to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
* The Internship during the second year vacation will help the students gain valuable work experience, that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
* Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
* State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest - Artificial Intelligence.

**Value additions in the Revamped Curriculum:**

|  |  |  |
| --- | --- | --- |
| **Semester** | **Newly introduced Components** | **Outcome / Benefits** |
| **I** | **Foundation Course**  To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning Literature and analysing the world through the literary lens  gives rise to a new perspective. | * Instill confidence among students * Create interest for the subject |
| **I, II, III, IV** | **Skill Enhancement papers** (Discipline centric / Generic / Entrepreneurial) | * Industry ready graduates * Skilled human resource * Students are equipped with essential skills to   make them employable |
| * Training on language and communication skills enable the students gain   knowledge and  exposure in the competitive world. |
| * Discipline centric skill will improve the Technical knowhow of solving real life   problems. |
| **III, IV, V & VI** | Elective papers | * Strengthening the domain knowledge * Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature * Emerging topics in higher education/ industry/ communication network / health sector etc. are introduced with   hands-on-training. |

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| **IV** | Elective Papers | | * Exposure to industry moulds students into solution providers * Generates Industry ready graduates * Employment opportunities enhanced |
| **V Semester** | Elective papers | | * Self-learning is enhanced * Application of the concept to real situation is conceived resulting   in tangible outcome |
| **VI Semester** | Elective papers | | * Enriches the study beyond the course. * Developing a research framework and   presenting their  independent and  intellectual ideas effectively. |
| **Extra Credits:**  **For Advanced Learners / Honors degree** | | | * To cater to the needs of peer learners / research   aspirants |
| **Skills acquired from the Courses** | | Knowledge, Problem Solving, Analytical  ability, Professional Competency, Professional Communication and Transferrable Skill | |

**Credit Distribution for UG Programmes**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sem I** | **Credit** | **H** | **Sem II** | **Credit** | **H** | **Sem III** | **Credit** | **H** | **Sem IV** | **Credit** | **H** | **Sem V** | **Credit** | **H** | **Sem VI** | **Credit** | **H** |
| Part 1. Language – Tamil | 3 | 6 | Part..1. Language – Tamil | 3 | 6 | Part..1. Language – Tamil | 3 | 6 | Part..1. Language – Tamil | 3 | 6 | 5.1 Core Course –\CC IX | 4 | 5 | 6.1 Core Course –  CC XIII | 4 | 6 |
| Part.2 English | 3 | 6 | Part..2 English | 3 | 6 | Part..2 English | 3 | 6 | Part..2 English | 3 | 6 | 5.2 Core Course – CC X | 4 | 5 | 6.2 Core Course –  CC XIV | 4 | 6 |
| 1.3 Core Course – CC I | 5 | 5 | 2..3 Core Course – CC III | 5 | 5 | 3.3 Core Course – CC V | 5 | 5 | 4.3 Core Course – CC VII  Core Industry Module | 5 | 5 | 5. 3.Core Course CC -XI | 4 | 5 | 6.3 Core Course –  CC XV | 4 | 6 |
| 1.4 Core Course – CC II | 5 | 5 | 2.4 Core Course – CC IV | 5 | 5 | 3.4 Core Course – CC VI | 5 | 5 | 4.4 Core Course –  CC VIII | 5 | 5 | 5. 4.Core Course –/ Project with viva- voce  CC -XII | 4 | 5 | 6.4 Elective -VII Generic/ Discipline Specific | 3 | 5 |
| 1.5 Elective I Generic/ Discipline Specific | 3 | 4 | 2.5 Elective II Generic/ Discipline Specific | 3 | 4 | 3.5 Elective III Generic/ Discipline Specific | 3 | 4 | 4.5 Elective IV Generic/ Discipline Specific | 3 | 3 | 5.5 Elective V Generic/ Discipline Specific | 3 | 4 | 6.5 Elective VIII  Generic/ Discipline Specific | 3 | 5 |
| 1.6 Skill Enhancement Course SEC-1 | 2 | 2 | 2.6 Skill Enhancement Course SEC-2 | 2 | 2 | 3.6 Skill Enhancement Course SEC-4,  (Entrepreneurial Skill) | 1 | 1 | 4.6 Skill Enhancement Course SEC-6 | 2 | 2 | 5.6 Elective VI Generic/ Discipline Specific | 3 | 4 | 6.6 Extension Activity | 1 | - |
| 1.7 Skill Enhancement -(Foundation Course) | 2 | 2 | 2.7 Skill Enhancement Course –SEC-3 | 2 | 2 | 3.7 Skill Enhancement Course SEC-5 | 2 | 2 | 4.7 Skill Enhancement Course SEC-7 | 2 | 2 | 5.7 Value Education | 2 | 2 | 6.7 Professional Competency Skill | 2 | 2 |
|  |  |  |  |  |  | 3.8 E.V.S. | - | 1 | 4.8 E.V.S | 2 | 1 | 5.8 Summer Internship /Industrial Training | 2 |  |  |  |  |
|  | **23** | **30** |  | **23** | **30** |  | **22** | **30** |  | **25** | **30** |  | **26** | **30** |  | **21** | **30** |
| **Total – 140 Credits** | | | | | | | | | | | | | | | | | |

**Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credit and Hours Distribution System**

**for all UG courses including Lab Hours**

**First Year – Semester-I**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part-1 | Language – Tamil | 3 | 6 |
| Part-2 | English | 3 | 6 |
| Part-3 | Core Courses & Elective Courses [in Total] | 13 | 14 |
| Part-4 | Skill Enhancement Course SEC-1 | 2 | 2 |
| Foundation Course | 2 | 2 |
|  |  | **23** | **30** |

**Semester-II**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part-1 | Language – Tamil | 3 | 6 |
| Part-2 | English | 3 | 6 |
| Part-3 | Core Courses & Elective Courses including laboratory [in Total] | 13 | 14 |
| Part-4 | Skill Enhancement Course -SEC-2 | 2 | 2 |
| Skill Enhancement Course -SEC-3 (Discipline / Subject Specific) | 2 | 2 |
|  |  | **23** | **30** |

**Second Year – Semester-III**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part-1 | Language - Tamil | 3 | 6 |
| Part-2 | English | 3 | 6 |
| Part-3 | Core Courses & Elective Courses including laboratory [in Total] | 13 | 14 |
| Part-4 | Skill Enhancement Course -SEC-4 (Entrepreneurial Based) | 1 | 1 |
| Skill Enhancement Course -SEC-5 (Discipline / Subject Specific) | 2 | 2 |
| E.V.S | - | 1 |
|  |  | **22** | **30** |

**Semester-IV**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part-1 | Language - Tamil | 3 | 6 |
| Part-2 | English | 3 | 6 |
| Part-3 | Core Courses & Elective Courses including laboratory [in Total] | 13 | 13 |
| Part-4 | Skill Enhancement Course -SEC-6 (Discipline / Subject Specific) | 2 | 2 |
| Skill Enhancement Course -SEC-7 (Discipline / Subject Specific) | 2 | 2 |
| E.V.S | 2 | 1 |
|  |  | **25** | **30** |

**Third Year**

**Semester-V**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| **Part-3** | Core Courses including Project / Elective Based | 22 | 26 |
| **Part-4** | Value Education | 2 | 2 |
| Internship / Industrial Visit / Field Visit | 2 | 2 |
|  |  | **26** | **30** |

**Semester-VI**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| **Part-3** | Core Courses including Project / Elective Based & LAB | 18 | 28 |
| **Part-4** | Extension Activity | 1 | - |
| Professional Competency Skill | 2 | 2 |
|  |  | **21** | **30** |

**Consolidated Semester wise and Component wise Credit distribution**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parts** | **Sem I** | **Sem II** | **Sem III** | **Sem IV** | **Sem V** | **Sem VI** | **Total Credits** |
| **Part I** | 3 | 3 | 3 | 3 | - | - | 12 |
| **Part II** | 3 | 3 | 3 | 3 | - | - | 12 |
| **Part III** | 13 | 13 | 13 | 13 | 22 | 18 | 92 |
| **Part IV** | 4 | 4 | 3 | 6 | 4 | 1 | 22 |
| **Part V** | - | - | - | - | - | 2 | 2 |
| **Total** | 23 | 23 | 22 | 25 | 26 | 21 | **140** |

**\*Part I. II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.**

| **Credit Distribution for B.Sc. Internet of Things**  **Semester I** | | | |
| --- | --- | --- | --- |
| **Component** | **Course Title** | **Credit** | **Hours** |
| Part-I | **Language – Tamil** | 3 | 6 |
| Part-II | **English** | 3 | 6 |
| Part III | **Core Course CC I**  Principles of Electronic Circuit Design | 5 | 5 |
| Part III | **Core Course Lab CC II**  Circuit Design Lab | 5 | 5 |
| Part III | **Elective Course I (Generic/Discipline Specific)**  Refer Annexure I | 3 | 4 |
| Part IV | **Skill Enhancement Course SEC- 1 (Non Major Elective)**  Refer Annexure II | 2 | 2 |
| Part IV | **Foundation Course FC**  Fundamentals of IoT and Applications | 2 | 2 |
|  | | 23 | 30 |
| **Semester II** | | | |
| Part-I | **Language – Tamil** | 3 | 6 |
| Part-II | **English** | 3 | 6 |
| Part III | **Core Course CC III**  Embedded System and Microcontroller | 5 | 5 |
| Part III | **Core Course Lab CC IV**  Embedded Systems Lab | 5 | 5 |
| Part III | **Elective Course II (Generic/Discipline Specific)**  Refer Annexure I | 3 | 4 |
| Part IV | **Skill Enhancement Course SEC- 2 (Non Major Elective)**  Refer Annexure II | 2 | 2 |
| Part IV | **Skill Enhancement Course SEC- 3 (Discipline / Generic Specific)**  Refer Annexure II | 2 | 2 |
|  | | 23 | 30 |
| **Semester III** | | | |
| Part-I | **Language – Tamil** | 3 | 6 |
| Part-II | **English** | 3 | 6 |
| Part III | **Core Course CC V**  RFID and Sensor Networks | 5 | 5 |
| Part III | **Core Course Lab CC VI**  Network Simulator – Lab | 5 | 5 |
| Part III | **Elective Course III (Generic/Discipline Specific)**  Refer Annexure I | 3 | 4 |
| Part IV | **Skill Enhancement Course SEC- 4**  **(Entrepreneurial Skill)**  Refer Annexure II | 1 | 1 |
| Part IV | **Skill Enhancement Course SEC- 5 (Discipline / Generic Specific)**  Refer Annexure II | 2 | 2 |
| Part IV | EVS | - | 1 |
|  | | 22 | 30 |
| **Semester IV** | | | |
| Part-I | **Language – Tamil** | 3 | 6 |
| Part-II | **English** | 3 | 6 |
| Part III | **Core Course CC VII**  **Core Industry Module**  Ardunio And Sensors | 5 | 5 |
| Part III | **Core Course Lab CC VIII**  Ardunio And Sensors Lab | 5 | 5 |
| Part III | **Elective Course IV (Generic/Discipline Specific)**  Refer Annexure I | 3 | 3 |
| Part IV | **Skill Enhancement Course SEC- 6 (Discipline / Generic Specific)**  Refer Annexure II | 2 | 2 |
| Part IV | **Skill Enhancement Course SEC- 7 (Discipline / Generic Specific)**  Refer Annexure II | 2 | 2 |
| Part IV | EVS | 2 | 1 |
|  | | 25 | 30 |
| **Semester V** | | | |
| Part III | **Core Course CC IX**  Implementing IoT with Raspberry Pi | 4 | 5 |
| Part III | **Core Course Lab CC X**  Raspberry Pi Lab | 4 | 5 |
| Part III | **Core Course Lab CC XI**  Network Communication and Security | 4 | 5 |
| Part III | **Core Course CC-XII / Project with viva voce** | 4 | 5 |
| Part III | **Elective Course V (Generic/Discipline Specific)**  Refer Annexure I | 3 | 4 |
| Part III | **Elective Course VI (Generic/Discipline Specific)**  Refer Annexure I | 3 | 4 |
| Part IV | Value Education | 2 | 2 |
| Part IV | **Summer Internship/ Industrial Training**  (Summer Vacation at the end of IV Semester activity | 2 |  |
|  |  | **26** | **30** |
| **Semester VI** | | | |
| Part III | **Core Course CC XIII**  Python Programming | 4 | 6 |
| Part III | **Core Course Lab CC XIV**  Python Programming Practical | 4 | 6 |
| Part III | **Core Course CC XV**  Android Application Development | 4 | 6 |
| Part III | **Elective Course VII (Generic/Discipline Specific)**  Refer Annexure I | 3 | 5 |
| Part III | **Elective Course VIII (Generic/Discipline Specific)**  Refer Annexure I | 3 | 5 |
| Part IV | **Professional Competency Skill** | 2 | 2 |
| Part V | **Extension Activity** | 1 |  |
|  | |  |  |
| **Total Credits** | |  | **140** |

**Annexure I**

**Suggested topics in Core component.**

1. Object Oriented Programming Using C++
2. C++ Programming Lab
3. Data Structures
4. PHP Scripting
5. Software Quality Assurance
6. Software Project Management
7. Software Enineering
8. Software Engineering Lab
9. Software Metrics
10. Machine Learning
11. Network Security
12. Mobile Application Development and more..

**Suggested topics in Elective Course**

**Generic Specific**

1. Discrete Mathematics – I
2. Discrete Mathematics-II
3. Statistical Methods and its Application-I
4. Statistical Methods and its Application-II
5. Optimization Techniques
6. Nano Technology
7. Introduction to Linear Algebra
8. Graph Theory and its Application
9. Financial Accounting
10. Cost and Management Accounting
11. Digital Logic Fundamentals
12. Numerical Methods

**Elective course – (1- 8)-Discipline Specific**

1. Natural Language Processing
2. Analytics for Service Industry
3. Cryptography
4. Big Data Analytics
5. IOT and its Applications
6. Human Computer Interaction
7. Fuzzy Logic
8. Artificial Intelligence
9. Robotics and its Applications
10. Computational Intelligence
11. Grid Computing
12. Trends in Computing
13. Artificial Neural Network
14. Agile Project Management and more..

**Suggested topics in Skill Enhancement (SEC1-SEC8) Course**

Annexure II

**Skill Enhancement Course**

1. Office Automation
2. Basics of Internet
3. Problem Solving Techniques
4. Multimedia Lab
5. Fundamentals of Information Technology
6. Introduction to HTML
7. Web Designing
8. Software Testing
9. Quantitative Aptitude
10. Mutimedia Systems
11. Advanced Excel
12. Biometrics
13. Cyber Forensics
14. Pattern Recognition
15. Enterprise Resource Planning
16. Robotics and Its Applications
17. Simulation and Modelling
18. Organization Behaviour and more..

**FIRST YEAR – SEMESTER – I**

**CORE – I: PRINCIPLES OF ELECTRONIC CIRCUIT DESIGN**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
|  | | **5** | 0 | 0 | I | **4** | **5** | **25** | **75** | | **100** |
| **Learning Objectives** | | | | | | | | | | | |
| **LO1** | To enable the students to understand and gain the knowledge on Electronic Circuit Design Principles | | | | | | | | | | |
| **LO2** | to acquaint the students with construction, theory and characteristics of the various kinds of electronic devices | | | | | | | | | | |
| **Prerequisites:** | | | | | | | | | | | |
| **Unit** | **Contents** | | | | | | | | | **No. of Hours** | |
| I | **Fundamentals of Electronics:** AC and DC Fundamentals- Resistors – Capacitors – Inductors – Series and parallel connections – Ohms Law – KCL- KVL – Super position theorem - Maximum power transfer theorem. Semiconductors- Types - Energy band Structure- Working and characteristics of PN Junction Diode- BJT- JFET- MOSFET- LED – LDR- Solar Cell- Photo Diode | | | | | | | | | **15** | |
| II | **Rectifiers and power supply:** Rectifier – Half wave rectifier  – full wave rectifier – bridge rectifier Compression - Filters – Capacitor Filter, Inductor Filter, L section and π section filters – Regulators –78XX and 79XX IC regulators – Single and Dual regulated power supply design using IC regulators. | | | | | | | | | **15** | |
| III | **Amplifier:** Definition – feedbacks – effect of negative feedback in amplifiers – Common emitter amplifier – Multistage amplifiers – RC Coupled amplifiers – Transformer coupled amplifier – Direct coupled amplifier – frequency response. | | | | | | | | | **15** | |
| IV | **Oscillator and Wave Shaping circuits:** Condition for Oscillation – Barkhausen criterion – Types of Oscillators – Hartley oscillator – Colpitt‟s oscillator – Crystal oscillator - RC phase shift oscillator – Astable Multivibrator – Mono stable Multivibrator – Bistable multivibrator – Schimit trigger  – UJT Relaxation oscillator - Clipesr-Clampers. | | | | | | | | | **15** | |
| V | **Linear ICs:** OpAmp: Ideal OpAmp – OpAmp Stages - OpAmp parameters – inverting and non inverting amplifiers – Adder and Subtractor – Multiplier and Divider – Differentiator – integrator - V to I and I to V converter – sample and hold circuit – Instrumentation amplifier.  **IC555 Timer:** Pin details of IC 555 – Block Diagram – Astable multivibrator - Mono stable multivibrator – Bistable Multivibrator. | | | | | | | | | **15** | |
| **TOTAL** | | | | | | | | | | **75** | |
| **CO** | **Course Outcomes** | | | | | | | | | | |
| CO1 | Recognize the fundamental concepts of solid state devices | | | | | | | | | | |
| CO2 | Understand the types and characteristics of various rectifiers, filters and regulators. | | | | | | | | | | |
| CO3 | Apply the operation of the devices on various amplifier designs | | | | | | | | | | |
| CO4 | Illustrate the functionality of different kinds of oscillator and wave shaping circuits | | | | | | | | | | |
| CO5 | Analyze the characteristics of the Linear IC‟s in different aspects. | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | |
|  | V.K. Metha, Rohit Metha - Principles of Electronics-S.Chand 12th edition | | | | | | | | | | |
|  | R.S Sedha –A Textbook of Applied Electronics - Revised Edition – 2008. | | | | | | | | | | |
|  | A. Sudhakar, Shyammohan S. Palli -Circuits and Networks: Analysis and Synthesis | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
|  | S. Salivahanan, N. SureshKumar-Electronic Devices and Circuits –4th Edi -2017 | | | | | | | | | | |
|  | Isaak D. Mayergoyz, W. Lawson - Basic Electric Circuit Theory | | | | | | | | | | |
| **NOTE: Latest Edition of Textbooks May be Used** | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | |
|  | https://[www.edx.org/course/principle-of-semiconductor-devices-part-i-semicond](http://www.edx.org/course/principle-of-semiconductor-devices-part-i-semicond) | | | | | | | | | | |
|  | https://[www.edx.org/course/principles-of-electronic-biosensors](http://www.edx.org/course/principles-of-electronic-biosensors) | | | | | | | | | | |

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| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **2** | **3** | **2** | **2** |
| **CO2** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO3** | **3** | **3** | **3** | **3** | **2** | **2** |
| **CO4** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO5** | **3** | **3** | **2** | **3** | **2** | **2** |
| **Weightage of course contributed to each PSO** | **15** | **14** | **11** | **15** | **10** | **10** |

**CORE – II: CIRCUIT DESIGN LAB**

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| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | | 0 | 0 | 5 | I | 4 | 5 | **25** | **75** | **100** |
| **Learning Objectives** | | | | | | | | | | |
| **LO1** | To enable the students to understand and gain the knowledge on Electronic Circuit Design Principles | | | | | | | | | |
| **LO2** | to acquaint the students with construction, theory and characteristics of the various kinds of electronic devices | | | | | | | | | |
| **List of Experiments:**   1. Data acquisition using Multimeter and oscillographic recorder 2. Connect an LED to GPIO pin 25 and control it through the command line. 3. Connect an LED to GPIO pin 24 and a Switch to GPIO 25 and control the LED with the switch. 4. The state of LED should toggle with every press of the switch Use DHT11 temperature sensor and print the temperature and humidity of the room with an interval of 15 seconds 5. Use joystick and display the direction on the screen | | | | | | | | | | |
| 1. Use Light Dependent Resistor (LDR) and control an LED that should switch-on/off depending on the light. 2. Create a traffic light signal with three colored lights (Red, Orange and Green) with a duty cycle of 5-2-10 seconds. 3. Switch on and switch of a DC motor based on the position of a switch. 4. Convert an analog voltage to digital value and show it on the screen. 5. Create a door lock application using a reed switch and magnet and give a beep when the door is opened. 6. Control a 230V device (Bulb) with Raspberry Pi using a relay. 7. Control a 230V device using a threshold temperature, using a temperature sensor. 8. Create an application that has three LEDs (Red, Green and white). The LEDs should follow the cycle (All Off, Red On, Green On, White On) for each clap (use sound sensor). 9. Create a web application for the above applications wherever possible with suitable modifications to get input and to send output. | | | | | | | | | | |
| **CO** | **Course Outcomes** | | | | | | | | | |
| CO1 | Recognize the fundamental concepts of solid state devices | | | | | | | | | |
| CO2 | Understand the types and characteristics of various rectifiers, filters and regulators. | | | | | | | | | |
| CO3 | Apply the operation of the devices on various amplifier designs | | | | | | | | | |
| CO4 | Illustrate the functionality of different kinds of oscillator and wave shaping circuits | | | | | | | | | |
| CO5 | Analyze the characteristics of the Linear IC‟s in different aspects. | | | | | | | | | |

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| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **2** | **3** | **2** | **2** |
| **CO2** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO3** | **3** | **3** | **3** | **3** | **2** | **2** |
| **CO4** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO5** | **3** | **3** | **2** | **3** | **3** | **2** |
| **Weightage of course contributed to each PSO** | **15** | **14** | **11** | **15** | **11** | **10** |

**FOUNDATION COURSE – I: FUNDAMENTALS OF IOT AND APPLICATIONS**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
|  | | **2** | 0 | 0 | I | **2** | **2** | **25** | **75** | | **100** |
| **Learning Objectives** | | | | | | | | | | | |
| **LO1** | To acquire the basic knowledge of students in Internet of Things and design mini projects based on its application | | | | | | | | | | |
| **Prerequisites:** | | | | | | | | | | | |
| **Unit** | **Contents** | | | | | | | | | **No. of Hours** | |
| I | **Fundamentals of IoT:** Introduction, Definitions & Characteristics of IoT, IoTArchitectures, Physical& Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M. | | | | | | | | | **6** | |
| II | **Sensors Networks :**Definition, Types of Sensors, Types of Actuators, Examples and Working, IoT Development Boards: Arduino IDE and Board Types, Raspberr Pi Development Kit, RFID Principles and components, Wirel ess Sensor Networks: History and Context, The node,Connecting nodes, Networking Nodes, WSN and IoT. | | | | | | | | | **6** | |
| III | **Wireless Technologies for IoT:** WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE,  Bacnet, Modbus.IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT.Edge  connectivity and protocols. | | | | | | | | | **6** | |
| IV | **Data Handling& Analytics:**Introduction, Bigdata, Types of data, Characteristics of Big data,Data handling Technologies, Flow of data, Data acquisition, Data Storage, Introduction to Hadoop. Introduction to data Analytics, Types of Data analytics, Local Analytics, Cloud analytics and applications. | | | | | | | | | **6** | |
| V | **Applications of IoT:**Home Automation, Smart Cities, Energy, Retail Management, Logistics,Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection. | | | | | | | | | **6** | |
| **TOTAL** | | | | | | | | | | **30** | |
| **CO** | **Course Outcomes** | | | | | | | | | | |
| CO1 | Recognize and understand the fundamentals of IoT Architecture and layer | | | | | | | | | | |
| CO2 | Understand the concept of sensor network | | | | | | | | | | |
| CO3 | Demonstrate the design procedures wireless access technologies | | | | | | | | | | |
| CO4 | Simplify the various data handling problems | | | | | | | | | | |
| CO5 | Categorize and analyse the applications of IOT | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | |
|  | HakimaChaouchi, ― “The Internet of Things Connecting Objects to the Web” ISBN :978-1- 84821-140-7, Wiley Publications | | | | | | | | | | |
|  | Olivier Hersent, David Boswarthick, and Omar Elloumi, ― “The Internet of Things:Key Applications and Protocols”, WileyPublications | | | | | | | | | | |
|  | Vijay Madisetti and ArshdeepBahga, ― “Internet of Things (A Hands-on- | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
|  | Daniel Minoli, ― “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118-47347-4, Willy Publications | | | | | | | | | | |
|  | Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling | | | | | | | | | | |
| **NOTE: Latest Edition of Textbooks May be Used** | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | |
|  | https://[www.edx.org/course/build-your-first-iot-application-with-](http://www.edx.org/course/build-your-first-iot-application-with-) arm?index=product&queryID=5909fc91a84332af2fd85a3475af41b8&position=1 | | | | | | | | | | |
|  | https://[www.edx.org/course/iot-systems-and-industrial-applications-with-](http://www.edx.org/course/iot-systems-and-industrial-applications-with-) design- thinking?index=product&queryID=5909fc91a84332af2fd85a3475af41b8&position=2 | | | | | | | | | | |

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| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **2** | **3** | **2** | **2** |
| **CO2** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO3** | **3** | **3** | **3** | **3** | **2** | **2** |
| **CO4** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO5** | **3** | **3** | **2** | **3** | **2** | **2** |
| **Weightage of course contributed to each PSO** | **15** | **14** | **11** | **15** | **10** | **10** |

**CORE – III: EMBEDDED SYSTEMS AND MICROCONTROLLER**

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| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
|  | | **5** | 0 | 0 | I | **4** | **5** | **25** | **75** | | **100** |
| **Learning Objectives** | | | | | | | | | | | |
| **LO1** | To understand the Concept of PIC microcontroller Architecture and its Applications | | | | | | | | | | |
| **LO2** | To develop the programming skills in PIC16F877 microcontroller. | | | | | | | | | | |
| **Prerequisites:** | | | | | | | | | | | |
| **Unit** | **Contents** | | | | | | | | | **No. of Hours** | |
| I | **PIC 16F87X Microcontroller:** Device overview – architecture – memory organization – status register – option register – INTCON register – PCON register – I/O ports – data EEPROM – instruction set: Byte oriented operations – Bit oriented operations – Literal and Control  operations. | | | | | | | | | **15** | |
| II | **Peripheral Features of 16F87X Microcontrollers:** TIMER0 Module – TIMER1 Module – TIMER2 Module – Capture/Compare/PWM Modules – I2 C transmission and reception – USART – ADC Module - Special features of the CPU : oscillator selection – power on reset – power up timer – oscillator start up timer – brown out reset –  interrupts – watchdog timer – SLEEP | | | | | | | | | **15** | |
| III | **Introduction to Embedded Systems:** Definition and classification – Overview of microprocessor, Microcontroller, and DSP – exemplary high performance processors – CISC and RISC architecture – hardware unit in an embedded System- software embedded into a system – exemplary applications – embedded systems on a chip  and in VLSI circuit | | | | | | | | | **15** | |
| IV | **Real Time Operating Systems:** Definitions of process, tasks, and threads – Operating system services – goals – structures kernel – process management – memory management – device management – file system organization and implementation – I/O sub systems – interrupt routine handling in RTOS – RTOS task scheduling models – handling of task scheduling – latency – deadlines   * round robin scheduling – cyclic scheduling – preemptive * critical session – static real time scheduling – IPC and synchronization – use of semaphore – priority inversion – deadlock – IPC using signals – mutex- flag- message queues – mailboxes – pipes- virtual sockets – remote   procedure calls | | | | | | | | | **15** | |
| V | **RTOS Programming Tools: Micro C/OS-II and Vx Works:** Study of Micro C/OS-II – VxWorks – other popular RTOS – RTOS system level functions – task service functions – time delay functions – memory allocation related functions – semaphore related functions – mailbox related functions – queue related functions case studies of Programming with RTOS – understanding case definition - multiple tasks and their functions – creating a list of tasks- functions and IPCs – exemplary coding steps | | | | | | | | | **15** | |
| **TOTAL** | | | | | | | | | | **75** | |
| **CO** | **Course Outcomes** | | | | | | | | | | |
| CO1 | Identify and understands the function of different blocks of PIC microcontroller. | | | | | | | | | | |
| CO2 | Understand the various instruction set programming techniques of PIC microcontroller. | | | | | | | | | | |
| CO3 | Demonstrate the use of interrupts and other programming techniques  related to micro-controllers. | | | | | | | | | | |
| CO4 | Analyze of RTOS based system design. | | | | | | | | | | |
| CO5 | Develop the programs for data transfer, arithmetic, logical and I/O port operations. | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | |
|  | Embedded Systems Architecture, Programming and Design, - Rajkamal, TATA McGraw- Hill, First reprint, 2003. | | | | | | | | | | |
|  | PIC 16F87X data book, Microchip Technology Inc., 2001 | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
|  | Programming 8 bit PIC microcontroller in C- Martin P. Bates | | | | | | | | | | |
|  | Embedded Controller Hardware Design - Ken Arnold | | | | | | | | | | |
|  | Designing Embedded Systems with PIC Microcontrollers Principles and applications – Tim Wilmshurst. | | | | | | | | | | |
| **NOTE: Latest Edition of Textbooks May be Used** | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | |
|  | https://onlinecourses.nptel.ac.in/noc20\_ee98/preview | | | | | | | | | | |
|  | https://nptel.ac.in/courses/108107029 | | | | | | | | | | |

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| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **2** | **3** | **2** | **2** |
| **CO2** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO3** | **3** | **3** | **3** | **3** | **2** | **2** |
| **CO4** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO5** | **3** | **3** | **2** | **3** | **2** | **2** |
| **Weightage of course contributed to each PSO** | **15** | **14** | **11** | **15** | **10** | **10** |

**CORE – IV: EMBEDDED SYSTEMS LAB**

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| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | | 0 | 0 | 5 | I | 4 | 5 | **25** | **75** | **100** |
| **Learning Objectives** | | | | | | | | | | |
| **LO1** | To develop the ability to design Microcomputer-based Embedded systems. | | | | | | | | | |
| **LO2** | To learn Microcomputer interfacing from both a Hardware and Software perspective | | | | | | | | | |
| **List of Experiments:** | | | | | | | | | | |
| 1. Arithmetic and logical operation 2. Switch and LED interfacing. 3. 4X4 matrix Keypad interfacing 4. 7 Segment Display Interface 5. Single digit timer using seven segment displays. 6. Temperature measurement. 7. DAC interface. 8. ADC Interface. 9. LCD interface. 10. Stepper motor control. 11. Serial communication using RS232C. 12. Serial Communication using I2C Protocol 13. DC Motor speed control using PWM | | | | | | | | | | |
| **CO** | **Course Outcomes** | | | | | | | | | |
| CO1 | Identify the functionality of development boards to implement embedded application. | | | | | | | | | |
| CO2 | Understand basic concepts in the embedded computing systems area | | | | | | | | | |
| CO3 | Apply knowledge and demonstrate the various addressing modes and data transfer instructions. | | | | | | | | | |
| CO4 | Analyze assembly language programs; select appropriate assemble into machine a cross assembler utility microcontroller. | | | | | | | | | |
| CO5 | Evaluate assembly language programs and download the machine code that will provide solutions real-world control problems. | | | | | | | | | |

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| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| 1. **CO1** | 1. **3** | 1. **2** | 1. **2** | 1. **3** | 1. **2** | 1. **2** |
| **CO2** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO3** | **3** | **3** | **3** | **3** | **2** | **2** |
| **CO4** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO5** | **3** | **3** | **2** | **3** | **3** | **2** |
| **Weightage of course contributed to each PSO** | **15** | **14** | **11** | **15** | **11** | **10** |

**CORE – V: RFID AND SENSOR NETWORKS**

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| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
|  | | **5** | 0 | 0 | I | **4** | **5** | **25** | **75** | | **100** |
| **Learning Objectives** | | | | | | | | | | | |
| **LO1** | Understand and designing Radio frequency identification (RFID) systems, middleware architectures for real-world applications. | | | | | | | | | | |
| **LO2** | Understanding RFID and related Architectures, RFID Principles and security issues | | | | | | | | | | |
| **LO3** | Determine road map for transformation of flexible electronics from foils to textiles | | | | | | | | | | |
| **LO4** | Understanding the implementation, challenges and design constraints of WSN | | | | | | | | | | |
| **LO5** | Knowing about the MAC layer and routing protocols in WSN | | | | | | | | | | |
| **Prerequisites:** | | | | | | | | | | | |
| **Unit** | **Contents** | | | | | | | | | **No. of Hours** | |
| I | Introduction of RFID, Automatic Identification Systems, A Comparison of Different ID Systems, Components of an RFID System, Differentiation Features of RFID Systems, Transponder Construction Formats, Frequency, Range and Coupling , Active and Passive Transponders, Information Processing in the Transponder , Selection Criteria for RFID Systems, Fundamental Operating Principles. | | | | | | | | | **15** | |
| II | Frequency Ranges and Radio Licensing Regulations, Coding and Modulation, Data Integrity, Multi-Access Procedures – Anticollision, Security of RFID Systems, Attacks on RFID Systems | | | | | | | | | **15** | |
| III | Wireless Sensor Networks- Introduction, Challenges and Constraints, Applications, Node Architecture, Operating Systems, Physical Layer | | | | | | | | | **15** | |
| IV | Medium Access Control: Characteristics of MAC Protocols in Sensor Networks, Contention- Free MAC Protocols, Contention-Based MAC Protocols, Network Layer: Various Routing Protocols. | | | | | | | | | **15** | |
| V | Security in WSN: Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks, Protocols and Mechanisms for Security, IEEE 802.15.4 and ZigBee Security | | | | | | | | | **15** | |
| **TOTAL** | | | | | | | | | | **75** | |
| **CO** | **Course Outcomes** | | | | | | | | | | |
| CO1 | Students will be familiar with RFID technology, various components involved. | | | | | | | | | | |
| CO2 | Getting familiar with various RFID standards, Students learn various Security issues involved in RFID. | | | | | | | | | | |
| CO3 | Students learn about Wireless Sensor Networks | | | | | | | | | | |
| CO4 | Familiar with WSN protocols routing algorithms. | | | | | | | | | | |
| CO5 | Various Security issues involved in Wireless Sensor Networks | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | |
|  | RFID Handbook, Klaus Finkenzeller,WILEY & SONS | | | | | | | | | | |
|  | Fundamentals of Wireless Sensor Networks: theory and practice by Waltenegus Dargie, Christian Poellabauer | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
|  | RFID and Sensor Networks Architecture, Protocols, Security and integration by Yan Zhang, Laurence T. Yang, Jining. | | | | | | | | | | |
|  | Ian F. Akyildiz, and Mehmet Can Vuran, Wireless Sensor Networks, 2010, Wiley, USA. | | | | | | | | | | |
|  | Wireless Sensor Networks Technology, protocols and applications by KAZEM SOHRABY, DANIEL MINOLI TAIEB ZNATI, JOHN WILEY & SONS, INC Publication. | | | | | | | | | | |
|  | REILLY, RFID Essentials By Bill Glover, Himanshu Bhatt. | | | | | | | | | | |
|  | W. Dargie and C. Poellabauer, Fundamentals of Wireless Sensor Networks, 2010, Wiley, USA. | | | | | | | | | | |
|  | Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, 2011, Wiley, USA. | | | | | | | | | | |
| **NOTE: Latest Edition of Textbooks May be Used** | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | |
|  | <http://www.redbooks.ibm.com/redpapers/pdfs/redp5242.pdf> | | | | | | | | | | |

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| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **2** | **3** | **2** | **2** |
| **CO2** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO3** | **3** | **3** | **3** | **3** | **2** | **2** |
| **CO4** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO5** | **3** | **3** | **2** | **3** | **2** | **2** |
| **Weightage of course contributed to each PSO** | **15** | **14** | **11** | **15** | **10** | **10** |

**CORE – VI: NETWORK SIMULATOR LAB**

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| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | | 0 | 0 | **4** | I | 4 | 5 | **25** | **75** | **100** |
| **Learning Objectives** | | | | | | | | | | |
| **LO1** | To study various trace file formats of network simulators. | | | | | | | | | |
| **LO2** | To implement and compare various MAC layer and routing protocols. | | | | | | | | | |
| **List of Experiments:** | | | | | | | | | | |
| 1. Introduction to network simulators used for wireless Ad Hoc and Sensor Networks. 2. Introduction to TCL scripting: demonstration of one small network simulation script. 3. To study various trace file formats of network simulators. 4. To implement and compare various MAC layer protocols. 5. To implement and compare AODV and DSR routing algorithms in MANET 6. To implement DSDV routing algorithms in MANET 7. To implement signal strength based link management routing protocols. 8. To calculate and compare average throughput for various TCP variants 9. To implement and compare various routing protocols for wireless sensor networks | | | | | | | | | | |
| **CO** | **Course Outcomes** | | | | | | | | | |
| CO1 | Identify the functionality of development boards to implement embedded application. | | | | | | | | | |
| CO2 | Understand basic concepts in the embedded computing systems area | | | | | | | | | |
| CO3 | Apply knowledge and demonstrate the various addressing modes and data transfer instructions. | | | | | | | | | |
| CO4 | Analyze assembly language programs; select appropriate assemble into machine a cross assembler utility microcontroller. | | | | | | | | | |
| CO5 | Evaluate assembly language programs and download the machine code that will provide solutions real-world control problems. | | | | | | | | | |

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| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| 1. **CO1** | 1. **3** | 1. **2** | 1. **2** | 1. **3** | 1. **2** | 1. **2** |
| **CO2** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO3** | **3** | **3** | **3** | **3** | **2** | **2** |
| **CO4** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO5** | **3** | **3** | **2** | **3** | **3** | **2** |
| **Weightage of course contributed to each PSO** | **15** | **14** | **11** | **15** | **11** | **10** |

**CORE – VII: ARDUINO AND SENSORS**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
|  | | **5** | 0 | 0 | I | **4** | **5** | **25** | **75** | | **100** |
| **Learning Objectives** | | | | | | | | | | | |
| **LO1** | To understand the interconnection and integration of the physical world and the cyber space | | | | | | | | | | |
| **LO2** | To design & develop IOT Devices. | | | | | | | | | | |
| **Prerequisites:** | | | | | | | | | | | |
| **Unit** | **Contents** | | | | | | | | | **No. of Hours** | |
| I | **Introduction to Arduino:** Pin configuration and architecture   * Device and platform features - Concept of digital and analog ports - Familiarizing with Arduino Interfacing Board   Introduction to Embedded C and Arduino platform - Arduino data types - Variables and constants - Operators - Control Statements - Arrays - Functions. | | | | | | | | | **15** | |
| II | **Arduino i/o Functions**: Pins Configured as INPUT - Pull-up Resistors - Pins Configured as OUTPUT- pinMode() Function- digitalWrite() Function- analogRead() function-Arduino Interrupts. | | | | | | | | | **15** | |
| III | **Arduino Displays:** Working with Serial Monitor - Line graph via serial monitor- Interfacing a 8 bit LCD to Arduino - Fixed one line static message display – Running Message display – Using the LCD Library of Arduino. | | | | | | | | | **15** | |
| IV | **Analog and Digital Sensors:**  **Analog Sensors:** Resistance-based sensors Voltage-based sensors Current-based sensors.  **Digital Sensors:** Buttons and switches On/o\_ devices I2C devices SPI devices RS-232 devices Other sensors. | | | | | | | | | **15** | |
| V | **Interfacing Sensors and Actuators:**  **Interfacing Sensors:** Button 60 - Analog input 61- I2C 65 -SPI 77 - Other protocols.  **Interfacing Actuators:** Switching devices - DC motors - Servos Stepper motors - Analog voltages - Human attention actuators. | | | | | | | | | **15** | |
| **TOTAL** | | | | | | | | | | **75** | |
| **CO** | **Course Outcomes** | | | | | | | | | | |
| CO1 | To understand the concept of Arduino Boards and tools | | | | | | | | | | |
| CO2 | To learn input and output function of ATmega Microcontroller | | | | | | | | | | |
| CO3 | To understand the knowledge of Display Interfacing with Arduino board | | | | | | | | | | |
| CO4 | To handle the Analog/Digital sensors application and interfacing | | | | | | | | | | |
| CO5 | To learn and understand the connection of motor functions | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | |
|  | Veneri, Giacomo, and Antonio Capasso- Hands-on Industrial Internet of Things: Create a Powerful Industrial IoT Infrastructure Using Industry 4.0, 1stEd., Packt Publishing Ltd, 2018 | | | | | | | | | | |
|  | D. Jude Hemanth and J. Anitha George A. Tsihrintzis- Internet of Medical Things Remote Healthcare Systems and Applications, covered by Scopus. | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
|  | Alasdair Gilchrist- Industry 4.0: The Industrial Internet of Things, 1st Ed., Apress, 2017. | | | | | | | | | | |
|  | Reis, Catarina I., and Marisa da Silva Maximiano, eds.- Internet of Things and advanced application in Healthcare, 1st Ed., IGI Global, 2016. | | | | | | | | | | |
| **NOTE: Latest Edition of Textbooks May be Used** | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | |
|  | https://books.google.com/books?id=P-xrzQEACAAJ&dq=arduino+book&hl=en&newbks=1&newbks\_redir=0&sa=X&ved=2ahUKEw jd34WU6Jn9AhUM7jgGHdx8Dd0Q6wF6BAgKEAE | | | | | | | | | | |
|  | https://[www.pdfdrive.com/arduino-home-automation-projects-automate-your-home-](http://www.pdfdrive.com/arduino-home-automation-projects-automate-your-home-) using-the-powerful-arduino-platform-d182643833.html | | | | | | | | | | |

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| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **2** | **3** | **2** | **2** |
| **CO2** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO3** | **3** | **3** | **3** | **3** | **2** | **2** |
| **CO4** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO5** | **3** | **3** | **2** | **3** | **2** | **2** |
| **Weightage of course contributed to each PSO** | **15** | **14** | **11** | **15** | **10** | **10** |

**CORE – VIII: ARDUINO AND SENSORS LAB**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | | 0 | 0 | **4** | I | 4 | **4** | **25** | **75** | **100** |
| **Learning Objectives** | | | | | | | | | | |
| **LO1** | To understand the design and Analysis of a various Communication Circuits | | | | | | | | | |
| **List of Experiments:** | | | | | | | | | | |
| 1. LED blinking using Arduino 2. Switch interface using Arduino 3. LCD interface using Arduino 4. DC motor speed control using Arduino 5. Servo motor control 6. Trafficlight control with Arduino 7. PWM generation with Arduino 8. LDR with Arduino 9. PIR sensor with Arduino 10. Ultra Sonic sensor with Arduino 11. Temperature and Humidity sensor with Arduino | | | | | | | | | | |
| **CO** | **Course Outcomes** | | | | | | | | | |
| CO1 | To be able to design hardware for IoT on different platforms for  devices that can be connected to internet | | | | | | | | | |
| CO2 | To be able to design software for IoT nodes and system | | | | | | | | | |
| CO3 | To develop understanding for IoT based system design for  different situations | | | | | | | | | |
| CO4 | Recognize the functionality of micro controller, latest version  processors and its applications | | | | | | | | | |
| CO5 | Acquire design thinking capability, ability to design a  component with realistic constraints, to solve real world engineering problems and analyse the results. | | | | | | | | | |

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| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | 1. **3** | 1. **2** | 1. **2** | 1. **3** | 1. **2** | 1. **2** |
| **CO2** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO3** | **3** | **3** | **3** | **3** | **2** | **2** |
| **CO4** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO5** | **3** | **3** | **2** | **3** | **3** | **2** |
| **Weightage of course contributed to each PSO** | **15** | **14** | **11** | **15** | **11** | **10** |

**CORE – IX: IMPLEMENTING IOT WITH RASPBERRY PI**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
|  | | **5** | 0 | 0 | I | **4** | **5** | **25** | **75** | | **100** |
| **Learning Objectives** | | | | | | | | | | | |
| **LO1** | to be equipped with a solid theoretical foundation, systematic professional knowledge and strong practical skills in the Raspberry Pi. | | | | | | | | | | |
| **LO2** | To design and deploy multiple IoT devices that could connect to the gateway. | | | | | | | | | | |
| **Prerequisites:** | | | | | | | | | | | |
| **Unit** | **Contents** | | | | | | | | | **No. of Hours** | |
| I | Getting Started with Raspberry Pi: Basic functionality of Raspberry Pi B+ board, setting up the board, configuration and use, implications of an operating system on the behavior of the Raspberry Pi as an IoT device, booting Raspberry Pi 3, Downloading an Operating System, format an SD card and booting the OS, Basics of Linux and its use, main features including navigating the file system and managing processes, text based user interface through the shell, overview of the graphic user interface for Raspian Linux distribution. | | | | | | | | | **15** | |
| II | Interfacing Hardware with the Raspberry Pi, Raspberry Pi Remote Access, operate the Raspberry Pi in “headless mode”, Bash Command line, operating Raspberry Pi without needing a GUI interface. **Basics of the Python programming language**, programming on the Raspberry Pi. Python on Raspberry Pi, Python Programming Environment, Python Expressions, Strings, Functions and Function arguments, Lists, List Methods, Control Flow. | | | | | | | | | **15** | |
| III | Communication with devices through the pins of the Raspberry Pi, RPi.GPIO library, Python Functions, setting up the pins, General purpose IO Pins, Protocol Pins, GPIO Access, applying digital voltages, and generating Pulse Width Modulated signals, Tkinter Python library, accessing pins through a graphic user interface | | | | | | | | | **15** | |
| IV | IoT Physical Servers and Cloud Offerings: Introduction to Cloud Storage models and communication APIs. Webserver – Web server for IoT, Cloud for IoT, Python web application framework. Designing a RESTful web API. Connecting to APIs | | | | | | | | | **15** | |
| V | **IoT Design using Raspberry Pi** IoT Applications based on Pi, LAMP Web-server, GPIO Control over Web Browser, Creating Custom Web Page for LAMP, Communicating data using on-board module, Home automation using Pi, Node-RED, MQTT Protocol, Using Node-RED Visual Editor on Rpi | | | | | | | | | **15** | |
| **TOTAL** | | | | | | | | | | **75** | |
| **CO** | **Course Outcomes** | | | | | | | | | | |
| CO1 | To learn the concept of Basic Concepts of Linux | | | | | | | | | | |
| CO2 | To understand Python Programming and libraries | | | | | | | | | | |
| CO3 | To apply the knowledge of basic concepts of Mobile Cloud Computing | | | | | | | | | | |
| CO4 | To anlyze the development technology for IoT | | | | | | | | | | |
| CO5 | To design real time IoT Devices | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | |
|  | Simon Monk, “Programming the Raspberry Pi: Getting Started with Python”, January 2012, McGraw Hill Professional | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
|  | Eben Upton and Gareth Halfacree, “Raspberry Pi User Guide”, August 2016, 4th edition, John Wiley & Sons | | | | | | | | | | |
|  | Alex Bradbury and Ben Everard, “Learning Python with Raspberry Pi”, Feb 2014, JohnWiley & Sons | | | | | | | | | | |
|  | Michael Margolis, “Arduino Cookbook”, First Edition, March 2011, O'Reilly Media, Inc | | | | | | | | | | |
| **NOTE: Latest Edition of Textbooks May be Used** | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | |
|  | https:/[/www.](http://www.raspberrypi.org/magpi-)r[aspberrypi.org/magpi-](http://www.raspberrypi.org/magpi-) issues/Projects\_Book\_v1.pdf | | | | | | | | | | |
|  | https://[www.pdfdrive.com/arduino-home-automation-projects-automate-your-home-](http://www.pdfdrive.com/arduino-home-automation-projects-automate-your-home-) using-the-powerful-arduino-platform-d182643833.html | | | | | | | | | | |

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| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **2** | **3** | **2** | **2** |
| **CO2** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO3** | **3** | **3** | **3** | **3** | **2** | **2** |
| **CO4** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO5** | **3** | **3** | **2** | **3** | **2** | **2** |
| **Weightage of course contributed to each PSO** | **15** | **14** | **11** | **15** | **10** | **10** |

**CORE – VIII: RASPBERRY PI LAB**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | | 0 | 0 | 5 | I | 4 | 5 | **25** | **75** | **100** |
| **Learning Objectives** | | | | | | | | | | |
| **LO1** | To design and deploy multiple IoT devices that could connect to the gateway. | | | | | | | | | |
| **List of Experiments:** | | | | | | | | | | |
| 1. Getting started with Raspberry Pi, Install Raspian on your SD card 2. Linux basic commands. 3. Coding simple programs in Python. 4. How to use Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device 5. How to have your Raspberry Pi interact with online services through the use of public APIs and SDKs 6. Understanding the connectivity of Raspberry-Pi with IR sensor. Write an application to detect obstacle and notify user using LEDs. 7. Design APP Using MIT App Inventor and Connect to Temperature Sensor | | | | | | | | | | |
| **CO** | **Course Outcomes** | | | | | | | | | |
| CO1 | To learn the concept of Basic Concepts of Linux | | | | | | | | | |
| CO2 | To understand Python Programming and libraries | | | | | | | | | |
| CO3 | To apply the knowledge of basic concepts of Mobile Cloud Computing | | | | | | | | | |
| CO4 | To anlyze the development technology for IoT | | | | | | | | | |
| CO5 | To design real time IoT Devices | | | | | | | | | |

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| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | 1. **3** | 1. **2** | 1. **2** | 1. **3** | 1. **2** | 1. **2** |
| **CO2** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO3** | **3** | **3** | **3** | **3** | **2** | **2** |
| **CO4** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO5** | **3** | **3** | **2** | **3** | **3** | **2** |
| **Weightage of course contributed to each PSO** | **15** | **14** | **11** | **15** | **11** | **10** |

**CORE – XI: NETWORK COMMUNICATION AND SECURITY**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
|  | | **5** | 0 | 0 | I | **4** | **5** | **25** | **75** | | **100** |
| **Learning Objectives** | | | | | | | | | | | |
| **LO1** | To Describe various communications networks and their components, and to | | | | | | | | | | |
| **LO2** | To Identify the function of a firewall, and how it keeps a computer secure and safe from viruses. Prepare a plan for anti-virus protection | | | | | | | | | | |
| **Prerequisites:** | | | | | | | | | | | |
| **Unit** | **Contents** | | | | | | | | | **No. of Hours** | |
| I | **Transmission Methods:** Digital Signal Analog Transmission  – Baud Rate - Analog Signal Digital Transmission – Parallel & Serial Communication – Asynchronous & Synchronous Communication – Simplex – Half Duplex - Full Duplex – Multiplexing - De-multiplexing - Types of Multiplexing. | | | | | | | | | **15** | |
| II | **Network Topologies:** Mesh Topology – Star Topology – Tree Topology – Ring – Bus – Hybrid – Basics of Switching – Router & Routing – Internet Topology – Architecture of an ISP – Logical Types of Topology. | | | | | | | | | **15** | |
| III | **Network Protocols:** OSI Model – Physical Layer – Data Link Layer – Network Layer – Transport Layer – Session Layer – Presentation Layer – Application Layer – Overview of Network Protocols. | | | | | | | | | **15** | |
| IV | **LAN Topologies:** Introduction – LAN Hardware – Implementing LAN – Fast LANS - Nonstandard LANS – Extending LANS – Virtual LANS – Token Passing Networks – FDDI – MAN – WAN. | | | | | | | | | **15** | |
| V | **Internet access & network security:** Introduction – Dial up Access – Leased lines – DSL - Cable Modems – DTE – DCE Interface – RS-232 & RS-449 Interface – SONET.  Network Security: Introduction – Types of Computer Attacks – Firewall – Virtual Private Network-Cryptography. | | | | | | | | | **15** | |
| **TOTAL** | | | | | | | | | | **75** | |
| **CO** | **Course Outcomes** | | | | | | | | | | |
| CO1 | Identify the components associated with Transmission methods. | | | | | | | | | | |
| CO2 | Understand the complete network architecture, Topology and switching and routing technologies. | | | | | | | | | | |
| CO3 | Illustrate the operations of various electronic circuits and their applications. | | | | | | | | | | |
| CO4 | Demonstrate the various networks protocols and network management skills | | | | | | | | | | |
| CO5 | Evaluate the issues in providing Quality-Of-Service for network  multimedia applications such as Internet, telephony& network security | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | |
|  | [Roberta Bragg](https://www.amazon.in/Roberta-Bragg/e/B001ILFKWS/ref=dp_byline_cont_book_1), [Mark Rhodes-Ousley](https://www.amazon.in/s/ref=dp_byline_sr_book_2?ie=UTF8&field-author=Mark+Rhodes-Ousley&search-alias=stripbooks), [Keith Strassberg](https://www.amazon.in/s/ref=dp_byline_sr_book_3?ie=UTF8&field-author=Keith+Strassberg&search-alias=stripbooks) “Network Security: The Complete Reference” July 2017, McGraw Hill Education | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
|  | Behrouz and Forouzan,(2006), Data Communication and Networking‖, 4th Edition, TMH. | | | | | | | | | | |
|  | Ajit Pal,(2014), Data Communication and Computer Networks, PHI. | | | | | | | | | | |
| **NOTE: Latest Edition of Textbooks May be Used** | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | |
|  | http://www.tutorialspoint.com/data\_communication\_computer\_network/ | | | | | | | | | | |
|  | <http://www.slideshare.net/zafar_ayub/data-communication-and-network-11903853> | | | | | | | | | | |
|  | <http://www.freetechbooks.com/data-communication-and-networks-f31.html> | | | | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- |
| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **2** | **3** | **2** | **2** |
| **CO2** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO3** | **3** | **3** | **3** | **3** | **2** | **2** |
| **CO4** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO5** | **3** | **3** | **2** | **3** | **2** | **2** |
| **Weightage of course contributed to each PSO** | **15** | **14** | **11** | **15** | **10** | **10** |

**Core XIII: python PROGRAMMING**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
| **CC9** | | **5** | **0** | **0** | **V** | **4** | **5** | **25** | **75** | | **100** |
| **Learning Objectives** | | | | | | | | | | | |
| **LO1** | Understand the concepts of Python programming. | | | | | | | | | | |
| **LO2** | To apply the OOPs concept in PYTHON programming. | | | | | | | | | | |
| **LO3** | To impart knowledge on demand and supply concepts | | | | | | | | | | |
| **LO4** | Learn to solve basic programming problems. | | | | | | | | | | |
| **Unit** | **Contents** | | | | | | | | | **No. of Hours** | |
| I | **Basics of Python Programming:** History of Python-Features of Python-Literal-Constants-Variables - Identifiers–Keywords-Built-in Data Types-Output Statements – Input Statements-Comments – Indentation- Operators-Expressions-Type conversions. **Python Arrays:** Defining and Processing Arrays – Array methods. | | | | | | | | | **15** | |
| II | **Control Statements:** Selection/Conditional Branching statements: if, if-else, nested if and if-elif-else statements. Iterative Statements: while loop, for loop, else suite in loop and nested loops. **Jump Statements:** break, continue and pass statements**.** | | | | | | | | | **15** | |
| III | **Functions:** Function Definition – Function Call – Variable Scope and its Lifetime-Return Statement. **Function Arguments**: Required Arguments, Keyword Arguments, Default Arguments and Variable Length Arguments- Recursion. **Python Strings:** String operations- Immutable Strings - Built-in String Methods and Functions - String Comparison. **Modules**: import statement- The Python module – dir() function – Modules and Namespace – Defining our own modules. | | | | | | | | | **15** | |
| IV | **Lists:** Creating a list -Access values in List-Updating values in Lists-Nested lists -Basic list operations-List Methods. Tuples: Creating, Accessing, Updating and Deleting Elements in a tuple – Nested tuples– Difference between lists and tuples. **Dictionaries:** Creating, Accessing, Updating and Deleting Elements in a Dictionary – Dictionary Functions and Methods - Difference between Lists and Dictionaries. | | | | | | | | | **15** | |
| V | **Python File Handling:** Types of files in Python - Opening and Closing files-Reading and Writing files: write() and writelines() methods- append() method – read() and readlines() methods – with keyword – Splitting words – File methods - File Positions- Renaming and deleting files. | | | | | | | | | **15** | |
| **TOTAL** | | | | | | | | | | **75** | |
| **CO** | **Course Outcomes** | | | | | | | | | | |
| CO1 | Outline the basic concepts in python language. | | | | | | | | | | |
| CO2 | Interpret different looping and conditional statements in python language | | | | | | | | | | |
| CO3 | Apply the various data types and identify the usage of control statements, loops, functions and Modules in python for processing the data | | | | | | | | | | |
| CO4 | Analyze and solve problems using basic constructs and techniques of python. | | | | | | | | | | |
| CO5 | Assess the approaches used in the development of interactive application. | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | |
|  | Reema Thareja, “Python Programming using problem solving approach”, First Edition, 2017, Oxford University Press. | | | | | | | | | | |
|  | Dr. R. Nageswara Rao, “Core Python Programming”, First Edition, 2017, Dream tech Publishers | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
|  | VamsiKurama, “Python Programming: A Modern Approach”, Pearson Education. | | | | | | | | | | |
|  | Mark Lutz, ”Learning Python”, Orielly. | | | | | | | | | | |
| **NOTE: Latest Edition of Textbooks May be Used** | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | |
|  | <https://www.programiz.com/python-programming> | | | | | | | | | | |
|  | https://www.guru99.com/python-tutorials.html | | | | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- |
| **MAPPING TABLE** | | | | | | |
| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **2** | **3** | **2** | **2** |
| **CO2** | **2** | **3** | **2** | **3** | **2** | **2** |
| **CO3** | **2** | **3** | **2** | **2** | **3** | **1** |
| **CO4** | **1** | **2** | **2** | **1** | **3** | **2** |
| **CO5** | **2** | **2** | **2** | **1** | **3** | **3** |
| **Weightage of course contributed to each PSO** | **10** | **12** | **10** | **10** | **13** | **10** |

**Core XIV: PYTHON PROGRAMMING-LAB**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
| **CC10** | | **0** | **0** | **6** | **V** | **4** | **6** | **25** | **75** | | **100** |
| **Learning Objectives** | | | | | | | | | | | |
| **LO1** | Understand the fundamentals of programming using Python, such as variables, data types, control structures, and functions. | | | | | | | | | | |
| **LO2** | Learn how to use Python libraries and modules to solve problems. | | | | | | | | | | |
| **LO3** | Practice writing Python code to solve real-world problems and build basic applications. | | | | | | | | | | |
| **LO4** | Gain experience with common programming paradigms, such as object-oriented programming and functional programming. | | | | | | | | | | |
| **LO5** | Understand best practices for debugging and testing code. | | | | | | | | | | |
| **List of Exercises** | | | | | | | | | | | |
| 1. Program using variables, constants, I/O statements in Python. 2. Program using Operators in Python. 3. Program using Conditional Statements. 4. Program using Loops. 5. Program using Jump Statements. 6. Program using Functions. 7. Program using Recursion. 8. Program using Arrays. 9. Program using Strings. 10. Program using Modules. 11. Program using Lists. 12. Program using Tuples. 13. Program using Dictionaries. 14. Program for File Handling. | | | | | | | | | | | |
| **TOTAL** | | | | | | | | | | **75** | |
| **CO** | **Course Outcomes** | | | | | | | | | | |
| CO1 | Understand the significance of control statements, loops and functions in creating  Simple programs. | | | | | | | | | | |
| CO2 | Interpret the core data structures available in python to store, process and sort the data. | | | | | | | | | | |
| CO3 | Develop the real time applications using python programming language. | | | | | | | | | | |
| CO4 | Analyze the real time problem using suitable python concepts. | | | | | | | | | | |
| CO5 | Assess the complex problems using appropriate concepts in python. | | | | | | | | | | |

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| **MAPPING TABLE** | | | | | | |
| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **3** | **2** | **3** | **3** |
| **CO2** | **3** | **3** | **2** | **2** | **3** | **3** |
| **CO3** | **3** | **2** | **2** | **3** | **3** | **2** |
| **CO4** | **3** | **2** | **3** | **3** | **2** | **2** |
| **CO5** | **3** | **3** | **3** | **3** | **3** | **2** |
| **Weightage of course contributed to each PSO** | **15** | **12** | **13** | **13** | **14** | **12** |

**CORE XV: ANDROID** **APPLICATION DEVELOPMENT**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
|  | | | **0** | **0** | **5** | **-** | **4** | **5** | **25** | **75** | | **100** |
| **Learning Objectives** | | | | | | | | | | | | |
| **LO1** | | To provide the students with the basics of Android Software Development tools and development of software on mobile platform. | | | | | | | | | | |
| **Unit** | | **Contents** | | | | | | | | | **No. of Hours** | |
| I | | Introduction to Android Operating System – Configuration of Android Environment- Create the First Android Application. Layout: Vertical, Vertical Scroll, horizontal, horizontal Scroll, Table Layout arrangement. **Designing User Interface:** Label Text - TextView – Password Text Box - Button –ImageButton – CheckBox – Image - RadioButton – Slider – Autocomplete text View. | | | | | | | | | **15** | |
| II | | User Interface: Spinner – Switch – Side Bar- ListView - List Picker - Image Picker - Notifier - Time and Date Picker - Web Viewer | | | | | | | | | **15** | |
| III | | **Media: Camcorder - Camera – Player – Speech Recognizer – Text to Speech – Video Player - Canvas** | | | | | | | | | **15** | |
| IV | | Maps: Maps - Sensor: Location Sensor – Barcode Scanner Social components: Contact Picker – Email Picker – Phone Number Picker – Phone Call - Social: Texting | | | | | | | | | **15** | |
| V | | Storage: Cloud DB – Tiny DB – Experimental – Fire DB | | | | | | | | | **15** | |
| **TOTAL** | | | | | | | | | | | **75** | |
| **CO** | | **Course Outcomes** | | | | | | | | | | |
| CO1 | | Chart the requirements needed for developing android application | | | | | | | | | | |
| CO2 | | Identify the results by executing the application in emulator or in android device | | | | | | | | | | |
| CO3 | | Apply proper interface setup, styles & themes, storing and management | | | | | | | | | | |
| CO4 | | Analyze the problem and add necessary user interface components, graphics and multimedia components into the application. | | | | | | | | | | |
| CO5 | | Evaluate the results by implementing the concept behind the problem with proper code. | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | | |
|  | | Karen Lang and Selim Tezel, (2022), Become an App Inventor The official guide from MIT App Inventor, Miteen Press, Walker Books Limited. | | | | | | | | | | |
| Reference Books | | | | | | | | | | | | |
| 1 | Wei – Meng Lee, (2012), Beginning Android 4 Application Development, Wiley India Edition. | | | | | | | | | | | |
| 2 | Deital, Android for Programmers-An App-Driven Approach,Second Edition. | | | | | | | | | | | |
| **NOTE: Latest Edition of Textbooks May be Used** | | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | |
|  | | http://ai2.appinventor.mit.edu/reference/ | | | | | | | | | | |
| 1. . | | http://appinventor.mit.edu/explore/paint-pot-extended-camera | | | | | | | | | | |

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| **MAPPING TABLE** | | | | | | |
| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **3** | **2** | **3** | **3** |
| **CO2** | **3** | **3** | **2** | **2** | **3** | **3** |
| **CO3** | **3** | **2** | **2** | **3** | **3** | **2** |
| **CO4** | **3** | **2** | **3** | **3** | **2** | **2** |
| **CO5** | **3** | **3** | **3** | **3** | **3** | **2** |
| **Weightage of course contributed to each PSO** | **15** | **12** | **13** | **13** | **14** | **12** |

**Suggested Topics in Core Component**

**OBJECT ORIENTED PROGRAMMING USING C++**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
|  | | **5** | **0** | **0** | **-** | **4** | **5** | **25** | **75** | | **100** |
| **Learning Objectives** | | | | | | | | | | | |
| **LO1** | To inculcate knowledge on Object-oriented concepts and programming using C++. | | | | | | | | | | |
| **LO2** | Demonstrate the use of various OOPs concepts with the help of programs | | | | | | | | | | |
| **Unit** | **Contents** | | | | | | | | | **No. of Hours** | |
| I | OOP Paradigm – Concepts of OOP – Benefits of OOP - Object Oriented Languages – Applications of OOP – OOP Design: Using UML as a Design Tool Beginning with C++ | | | | | | | | | **15** | |
| II | Tokens, Expressions and Control Structures - Functions in C++ : Function Prototyping – Call by Reference - Return by Reference – Inline Function – Default Arguments – Const Arguments – Recursion – Function Overloading – Classes and Objects | | | | | | | | | **15** | |
| III | Constructors and Destructors: Constructors – Parameterized Constructors – Multiple Constructors – Constructor with default Arguments – Copy Constructors – Dynamic Constructor – Destructors – Operator Overloading and Type Conversions: Operator Overloading – Overloading Unary Operators – Overloading Binary operators – Rules for Operator Overloading – Type Conversions | | | | | | | | | **15** | |
| IV | Inheritance: Introduction – Types of Inheritance – Virtual Base Classes – Abstract Classes – Pointers - Virtual Function - Polymorphism | | | | | | | | | 15 | |
| V | Templates: Class Templates – Function Templates – Overloading of template Function – Exception Handling | | | | | | | | | 15 | |
| **TOTAL** | | | | | | | | | | 75 | |
| **CO** | Course Outcomes | | | | | | | | | | |
| CO1 | Outline the C++ programming fundamentals and the concepts of object-oriented programming like object and class, Encapsulation, inheritance and polymorphism. | | | | | | | | | | |
| CO2 | Classify the control structures, types of constructors, inheritance and different type conversion mechanisms. | | | | | | | | | | |
| CO3 | Analyze the importance of object oriented programming features like polymorphism, reusability, generic programming, data abstraction and the usage of exception handling. | | | | | | | | | | |
| CO4 | Determine the use of object oriented features such as classes, inheritance and templates to develop C++ programs for complex problems. | | | | | | | | | | |
| CO5 | Create a program in C++ by implementing the concepts of object-oriented programming. | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | |
|  | E. Balaguruswamy, (2013), “Object Oriented Programming using C++”, 6th Edition, Tata McGraw Hill. | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
| 1 | Bjarne Stroustrup, “The C++ Programming Language”, Fourth Edition, Pearson Education. | | | | | | | | | | |
| 2 | Hilbert Schildt, (2009), “C++ - The Complete Reference”, 4th Edition, Tata McGrawHill | | | | | | | | | | |
| **NOTE: Latest Edition of Textbooks May be Used** | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | |
| 1. | http:/fahad.cprogramming.blogspot.com/p/c-simple-examples.html | | | | | | | | | | |
| 2. | http://www.sitesbay.com/cpp/cpp-polymorphism | | | | | | | | | | |

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| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **2** | **3** | **3** | **2** |
| **CO2** | **3** | **3** | **2** | **3** | **3** | **2** |
| **CO3** | **3** | **3** | **3** | **3** | **3** | **2** |
| **CO4** | **3** | **3** | **2** | **3** | **3** | **2** |
| **CO5** | **3** | **3** | **2** | **3** | **3** | **2** |
| **Weightage of course contributed to each PSO** | **15** | **14** | **11** | **15** | **15** | **10** |

**C++ Programming Lab**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
|  | | **0** | **0** | **5** | **-** | **4** | **5** | **25** | **75** | | **100** |
| **Learning Objectives** | | | | | | | | | | | |
| **LO1** | To inculcate knowledge on Object-oriented concepts and programming using C++. | | | | | | | | | | |
| **LO2** | Demonstrate the use of various OOPs concepts with the help of programs | | | | | | | | | | |
|  | **List of Excercises** | | | | | | | | |  | |
| Exercises:   1. Working with Classes and Objects 2. Using Constructors and Destructors 3. Using Function Overloading 4. Using Operator Overloading 5. Using Type Conversions 6. Using Inheritance 7. Using Polymorphism 8. Using Console I/O 9. Using Templates 10. Using Exceptions   **TOTAL 75** | | | | | | | | | | | |
| **CO** | Course Outcomes | | | | | | | | | | |
| CO1 | Understand the fundamentals of C++ programming structure | | | | | | | | | | |
| CO2 | Identify the basic features of OOPS such as classes, objects, polymorphism, inheritance | | | | | | | | | | |
| CO3 | Analyze the concept of inheritance with the understanding of early and late binding, usage of exception handling, constructors, destructors, generic programming and type conversions | | | | | | | | | | |
| CO4 | Determine the use of various data structures such as stacks, queues and lists to solve various computing problems in C++ by incorporating OOPS concepts. | | | | | | | | | | |
| CO5 | Develop a program in C++ with the concepts of object oriented programming to solve real-world problems. | | | | | | | | | | |

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| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **2** | **3** | **3** | **2** |
| **CO2** | **3** | **3** | **2** | **3** | **3** | **2** |
| **CO3** | **3** | **3** | **3** | **3** | **3** | **2** |
| **CO4** | **3** | **3** | **2** | **3** | **3** | **2** |
| **CO5** | **3** | **3** | **2** | **3** | **3** | **2** |
| **Weightage of course contributed to each PSO** | **15** | **14** | **11** | **15** | **15** | **10** |

**DATA STRUCTURES**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
|  | | 4 | 0 | 0 | II | 4 | 4 | **25** | **75** | | **100** |
| **Learning Objectives** | | | | | | | | | | | |
| **LO1** | To become familiar with the various data structures and their applications | | | | | | | | | | |
| **LO2** | to increase the understanding of basic concepts of the design and use of algorithms | | | | | | | | | | |
| **Prerequisites:** | | | | | | | | | | | |
| **Unit** | **Contents** | | | | | | | | | **No. of Hours** | |
| I | Introduction and overview: Basic Terminology – Data Structures – Operations - Algorithms:  Complexity – Time Space – Algorithmic Notation – Control Structures – Complexity of  Algorithms – Notations Arrays: Representation – Operations - Linear Search – Binary Search | | | | | | | | | **12** | |
| II | Stack: Representation – Arithmetic expressions: Polish Notation – Recursion: Towers of Hanoi  - Queue –Priority Queue - Linked Lists: Introduction – Representation of Linked Lists – Traversing a Linked Lists – Searching a Linked List | | | | | | | | | **12** | |
| III | Insertion into a Linked List – Deletion into Linked List – Header Linked Lists – Two-way Lists  –Doubly Linked List - Trees : Binary Trees – Representation – Traversal using Recursion – Binary Search Trees | | | | | | | | | **12** | |
| IV | Sorting : Bubble Sort Insertion Sort, Selection Sort, Merge Sort, Quick Sort, Heap Sort | | | | | | | | | **12** | |
| V | Graph – Graph Theory Terminology –Sequential Representation – Warshalls Algorithm – Shortest Path – Linked Representation - Traversals – Dynamic Programming – All Pairs  Shortest Path - Greedy – Knapsack – Back Tracking – 8 Queens | | | | | | | | | **12** | |
| **TOTAL** | | | | | | | | | | **60** | |
| **THEORY 100%** | | | | | | | | | | | |
| **CO** | **Course Outcomes** | | | | | | | | | | |
| CO1 | Outline the different fundamental concepts of data structures | | | | | | | | | | |
| CO2 | Make use of different memory representation for data  storage and apply various operations | | | | | | | | | | |
| CO3 | Construct an algorithm for different data structure  operations. | | | | | | | | | | |
| CO4 | Analyse the data structures applications. | | | | | | | | | | |
| CO5 | Discover suitable techniques to provide solution for solving  the problems. | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | |
|  | Seymour Lipschutz (1986), ―Theory and Problems of Data Structures‖, Tata McGraw- Hill  Edition | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
|  | E.Horowitz, S.Sahni, S.Rajasekaran (1998), ―Computer Algorithms‖, Galgotia Publications. | | | | | | | | | | |
|  | Robert Kruse, C.L.Tondo, Bruce Leung, ―Data Structures and Program Design in C‖, Second  Edition, Prientice Hall Publications | | | | | | | | | | |
| **NOTE: Latest Edition of Textbooks May be Used** | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | |
|  | http://www.cs.sunysb.edu/~skiena/214/lectures/ | | | | | | | | | | |
|  | http://datastructures.itgo.com/graphs/dfsbfs.htm | | | | | | | | | | |
|  | http://oopweb.com/Algorithms/Documents/PLDS210/VolumeFrames.html | | | | | | | | | | |
|  | <http://discuss.codechef.com/questions/48877/data-structures-and-algorithms> | | | | | | | | | | |
|  | http://code.tutsplus.com/tutorials/algorithms-and-data-structures--cms-20437 | | | | | | | | | | |
|  | ttps://www.tutorialspoint.com/data\_structures\_algorithms/insertion\_sort\_algorithm.htm (Unit IV : Insertion Sorting) | | | | | | | | | | |

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| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **2** | **3** | **3** | **3** |
| **CO2** | **3** | **3** | **2** | **3** | **3** | **3** |
| **CO3** | **3** | **3** | **3** | **3** | **3** | **2** |
| **CO4** | **3** | **3** | **2** | **3** | **3** | **3** |
| **CO5** | **3** | **3** | **2** | **3** | **3** | **2** |
| **Weightage of course contributed to each PSO** | **15** | **14** | **11** | **15** | **15** | **13** |

**PHP SCRIPTING – PRACTICAL**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | **Total** | |
|  | | 0 | 0 | 5 | V | 4 | 5 | 25 | 75 | 100 | |
| **Learning Objectives** | | | | | | | | | | | |
| **LO1** | To enable the students to understand, analyze and build dynamic web pages using PHP and jQuery with MySql database | | | | | | | | | | |
| **Prerequisites:** | | | | | | | | | | | |
| **Unit** | **Contents** | | | | | | | | | | **No. of Hours** |
| I | Introduction to PHP : Language Basics : Lexical Structure – Data Types – Variables - Expressions and Operators – Flow – Control statements – Embedding PHP in Web Pages Exercises:  * 1. Control Structures   2. Working with Forms. | | | | | | | | | | **15** |
| II | Functions : Defining a function – Variable Scope - Function Parameters – Strings : Encoding and Escaping – Comparing Strings – Manipulating and Searching Strings – Arrays: Single and Multidimensional Arrays – Traversing Arrays – Sorting Exercises:  * 1. String Manipulations   2. Arrays   3. Functions   4. Sorting | | | | | | | | | | **15** |
| III | Classes and Objects – Introspection – Serialization – Web Techniques: Processing Forms – Setting Response Headers – Maintaining State : Cookies and Session-Graphics Exercises:  * 1. Classes and Objects   2. Cookies and Sessions   3. Graphics | | | | | | | | | | **15** |
| IV | Working with MySQL Database: Select data from a single table – Select data from multiple tables- Performing DML operations Exercises:  * 1. Working with single table   2. Working with multiple tables | | | | | | | | | | **15** |
| V | jQuery Fundamentals: Requirements of jQuery- JavaScript Premier – jQuery Core – DOM Selection and Manipulation – Event Handling – HTML Forms and Data – jQuery with PHP Exercises:  * 1. Event Handling   2. Handling HTML Forms with jQuery | | | | | | | | | | **15** |
| **TOTAL** | | | | | | | | | | | **75** |
| **CO** | **Course Outcomes** | | | | | | | | | | |
| CO1 | Demonstrate simple programs using PHP and jQuery | | | | | | | | | | |
| CO2 | Apply the interface setup, styles & themes for the given application | | | | | | | | | | |
| CO3 | Analyze the problem and add necessary user interface components, multimedia components and web data source into the application | | | | | | | | | | |
| CO4 | Evaluate the results by implementing the correct techniques on the web form | | | | | | | | | | |
| CO5 | Construct web applications with the facilitated components in PHP and jQuery | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | |
|  | Kevin Tatroe, Peter MacIntyre, Rasmus Lerdorf, “ Programming PHP”, O‘Reilly Publications, Third Edition | | | | | | | | | | |
|  | Joel Murach, Ray Harris (2010), “PHP and MySQL”, Shroff Publishers & Distributors | | | | | | | | | | |
|  | Cesar Otero, Rob Lorsen (2012), “Professional jQuery”, John Wiley Sons & Inc | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
|  | W. Jason Gilmore (2010), “Beginning PHP & MySql”, Apress | | | | | | | | | | |
|  | Larry Ullman (2008), “PHP 6 and MySQL 5”, Pearson Education | | | | | | | | | | |
|  | John Coggeshall (2006), “PHP 5”, Pearson Education | | | | | | | | | | |
|  | Michale C. Glass (2004), “Beginning PHP, Apache, MySQL Web Development”, Wiley DreamTech Press | | | | | | | | | | |
|  | Robin Nixon (2013), “Learning PHP, MySQL, JavaScript & CSS”, O‘Reilly, 2nd Edition | | | | | | | | | | |
|  | Jack Franlin (2013), “Beginning jQuery”, Apress, Springer Science | | | | | | | | | | |
| **NOTE: Latest Edition of Textbooks May be Used** | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | |
|  | <http://www.w3schools.com/jquery/> | | | | | | | | | | |
|  | <http://www.ccc.commnet.edu/faculty/sfreeman/cst%20250/jQueryNotes.pdf> | | | | | | | | | | |
|  | <http://www.w3schools.com/php/> | | | | | | | | | | |
|  | <http://www.tutorialspoint.com/php/> | | | | | | | | | | |
|  | <http://www.tutorialspoint.com/mysql/> | | | | | | | | | | |

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| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **2** | **3** | **3** | **2** |
| **CO2** | **3** | **3** | **2** | **2** | **2** | **3** |
| **CO3** | **3** | **2** | **3** | **2** | **2** | **3** |
| **CO4** | **3** | **2** | **2** | **2** | **2** | **3** |
| **CO5** | **3** | **2** | **2** | **3** | **2** | **2** |
| **Weightage of course contributed to each PSO** | **15** | **11** | **11** | **12** | **11** | **13** |

**Software Quality Assurance**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
|  | | **4** | 0 | 0 | I | **4** | **4** | **25** | **75** | | **100** |
| **Learning Objectives** | | | | | | | | | | | |
| **LO1** | To enable the students to learn the Concepts and Principles of SQA. | | | | | | | | | | |
| **LO2** | To learn the principles of SQA and must be able to judge the quality of software. | | | | | | | | | | |
| **Prerequisites:** | | | | | | | | | | | |
| **Unit** | **Contents** | | | | | | | | | **No. of Hours** | |
| I | Introduction to software quality – Software modeling – Scope of the software quality program – Establishing quality goals – Purpose, quality of goals – SQA planning software – Productivity and documentation. | | | | | | | | | **12** | |
| II | Software quality assurance plan – Purpose and Scope, Software quality assurance management - Organization – Quality tasks – Responsibilities – Documentation. | | | | | | | | | **12** | |
| III | Standards, Practices, Conventions and Metrics, Reviews and Audits – Management, Technical - review – Software inspection process – Walk through process – Audit process – Test processes – ISO, CMM compatibility – Problem reporting and corrective action. | | | | | | | | | **12** | |
| IV | Tools, Techniques and methodologies, Code control, Media control, Supplier control, Records collection, Maintenance and retention, Training and risk management | | | | | | | | | **12** | |
| V | ISO 9000 model, CMM model, Comparisons, ISO 9000 weaknesses, cmm weaknesses, SPICE – Software process improvement and capability determination. | | | | | | | | | **12** | |
| **TOTAL** | | | | | | | | | | **60** | |
| **CO** | **Course Outcomes** | | | | | | | | | | |
| CO1 | Understand the basics of software quality, modeling, and software quality assurance planning software. | | | | | | | | | | |
| CO2 | Knowledge on software quality assurance plan, quality tasks and documentation. | | | | | | | | | | |
| CO3 | Understand the standards, practices, metrics, software inspection process, ISO CMM. | | | | | | | | | | |
| CO4 | Understand the tools and techniques in software quality control, maintenance and training, risk management. | | | | | | | | | | |
| CO5 | Knowledge in software quality standards and standard ISO 9000 model and its weakness, SPICE. | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | |
|  | Mordechai Ben, Meachem and Garry S. Marliss, Software Quality – Producing Practical, Consistent Software, International Thompson Computer Press, 1997 | | | | | | | | | | |
|  | Watt. S. Humphrey, Managing Software Process, Addison Wesley, 1998. | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
|  | Philip.B.Crosby, Quality is Free: The Art of Making Quality Certain, Mass Market, 1992. | | | | | | | | | | |
| **NOTE: Latest Edition of Textbooks May be Used** | | | | | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- |
| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **2** | **3** | **2** | **2** |
| **CO2** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO3** | **3** | **3** | **3** | **3** | **2** | **2** |
| **CO4** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO5** | **3** | **3** | **2** | **3** | **2** | **2** |
| **Weightage of course contributed to each PSO** | **15** | **14** | **11** | **15** | **10** | **10** |

**SOFTWARE PROJECT MANAGEMENT**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
|  | | **4** | **0** | **0** | **-** | **4** | **4** | **25** | **75** | | **100** |
| **Learning Objectives** | | | | | | | | | | | |
| **LO1** | To define and highlight importance of software project management. | | | | | | | | | | |
| **LO2** | To formulate and define the software management metrics & strategy in managing projects | | | | | | | | | | |
| **LO3** | Understand to apply software testing techniques in commercial environment | | | | | | | | | | |
| **Unit** | **Contents** | | | | | | | | | **No. of Hours** | |
| I | Introduction to Competencies - Product Development Techniques - Management Skills - Product Development Life Cycle - Software Development Process and models - The SEI CMM - International Organization for Standardization. | | | | | | | | | **12** | |
| II | Managing Domain Processes - Project Selection Models - Project Portfolio Management - Financial Processes - Selecting a Project Team - Goal and Scope of the Software Project -Project Planning - Creating the Work Breakdown Structure - Approaches to Building a WBS - Project Milestones - Work Packages - Building a WBS for Software. | | | | | | | | | **12** | |
| III | Tasks and Activities - Software Size and Reuse Estimating - The SEI CMM - Problems and Risks - Cost Estimation - Effort Measures - COCOMO: A Regression Model - COCOMO II - SLIM: A Mathematical Model - Organizational Planning - Project Roles and Skills Needed. | | | | | | | | | **12** | |
| IV | Project Management Resource Activities - Organizational Form and Structure - Software Development Dependencies - Brainstorming - Scheduling Fundamentals - PERT and CPM - Leveling Resource Assignments - Map the Schedule to a Real Calendar - Critical Chain Scheduling. | | | | | | | | | **12** | |
| V | Quality: Requirements – The SEI CMM - Guidelines - Challenges - Quality Function Deployment - Building the Software Quality Assurance - Plan - Software Configuration Management: Principles - Requirements - Planning and Organizing - Tools - Benefits - Legal Issues in Software - Case Study | | | | | | | | | **12** | |
| **TOTAL** | | | | | | | | | | **60** | |
| **CO** | **Course Outcomes** | | | | | | | | | | |
| CO1 | Understand the principles and concepts of project management | | | | | | | | | | |
| CO2 | Knowledge gained to train software project managers | | | | | | | | | | |
| CO3 | Apply software project management methodologies. | | | | | | | | | | |
| CO4 | Able to create comprehensive project plans | | | | | | | | | | |
| CO5 | Evaluate and mitigate risks associated with software development process | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | |
|  | Robert T. Futrell, Donald F. Shafer, Linda I. Safer, “Quality Software Project Management”, Pearson Education Asia 2002. | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
| 1. | Pankaj Jalote, “Software Project Management in Practice”, Addison Wesley 2002. | | | | | | | | | | |
| 2. | Hughes, “Software Project Management”, Tata McGraw Hill 2004, 3rd Edition. | | | | | | | | | | |
| **NOTE: Latest Edition of Textbooks May be Used** | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | |
| 1. | NPTEL & MOOC courses titled Software Project Management | | | | | | | | | | |
| 2. | www.smartworld.com/notes/software-project-management | | | | | | | | | | |

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| **MAPPING TABLE** | | | | | | |
| **CO/ PSO** | **PSO1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **1** | **2** | **2** | **2** |
| **CO2** | **3** | **1** | **3** | **2** | **2** | **2** |
| **CO3** | **2** | **3** | **2** | **3** | **3** | **3** |
| **CO4** | **3** | **3** | **2** | **3** | **3** | **2** |
| **CO5** | **2** | **2** | **2** | **3** | **3** | **3** |
| **Weightage of course contributed to each PSO** | **13** | **11** | **10** | **13** | **13** | **12** |

**SOFTWARE ENGINEERING**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
|  | | 5 | 0 | 0 | V | **3** | 5 | **25** | **75** | | **100** |
| **Learning Objectives** | | | | | | | | | | | |
| **LO1** | This paper familiarizes the students about the processes, forms, tasks,  techniques and tools involved in Software Engineering | | | | | | | | | | |
| **LO2** | To use the necessary for software  engineering practice. | | | | | | | | | | |
| **Prerequisites:** | | | | | | | | | | | |
| **Unit** | **Contents** | | | | | | | | | **No. of Hours** | |
| I | Introduction to Software Engineering: Definition - The changing nature of software - Software Myths - Terminologies - Role of Management in Software Development - Software  Life Cycle Models: The Waterfall Model - Increment Process Model - Evolutionary Process  Model - The Unified Process. | | | | | | | | | **15** | |
| II | Software Requirements Analysis and Specifications: Requirements Engineering - Type  of Requirements - Feasibility Studies - Requireents Elicitation - Requirements Analysis - Requirements Documentation - Requirements Validation. | | | | | | | | | **15** | |
| III | Software Project Planning: Size Estimation - Cost Estimation - The Constructive  Cost Model (COCOMO) - COCOMO II - The Putnam Resource Allocation Model - Software  Risk Management - Software Design: Definition - Modularity - Strategy of Design - Function  Oriented Design. | | | | | | | | | **15** | |
| IV | Software Testing: A Strategic Approach to Software Testing - Terminologies - Functional Testing - Structural Testing - Levels of Testing - Validation Testing - Testing Tools. | | | | | | | | | **15** | |
| V | Software Reliability: Basic Concepts - Software Quality - McCall Software Quality  Model - Boehm Software Quality Model - Capability Maturity Model - Software Maintenance:  Definition - Process - Models - Configuration Management -Documentation. | | | | | | | | | **15** | |
| **TOTAL** | | | | | | | | | | **75** | |
| **THEORY & PROBLEM** | | | | | | | | | | | |
| **CO** | **Course Outcomes** | | | | | | | | | | |
| CO1 | Define the basic terminologies involved in the entire software developmental  life cycle | | | | | | | | | | |
| CO2 | Identify suitable models, techniques and tools for the development of a  software product | | | | | | | | | | |
| CO3 | Apply software engineering perspective through requirements analysis,  software design and construction, verification, and validation to develop  solutions to modern problems | | | | | | | | | | |
| CO4 | Compare and contrast different process, cost, quality models and testing  techniques | | | | | | | | | | |
| CO5 | Estimate the project cost using suitable cost estimation models, rate the  software risks and evaluate management strategies for effective software  development | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | |
|  | K.K Agarwal, Yogesh Singh (2009), ―Software Engineering‖, 3 rd Edition, New Age  International Publishers | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
|  | Roger S. Pressman, ―Software Engineering – A Practioners Approach‖, 5 th Edition, Tata  Mc Graw Hill Publication. | | | | | | | | | | |
|  | Panaj Jalote (2005), ―An Integrated Approach to Software Engineering‖, 3 rd Edition,  Narosa Publication. | | | | | | | | | | |
|  | Thomas T. Baker, ―Writing Software Documentation – A task oriented approach‖, Second  Edition, Pearson Education, 2004. | | | | | | | | | | |
|  | Rajib Mall, ―Fundamentals of Software Engineering‖, Second Edition, Prentice Hall. | | | | | | | | | | |
| **NOTE: Latest Edition of Textbooks May be Used** | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | |
|  | http://www/tutorialspoint.com/software\_engineering | | | | | | | | | | |
|  | http://www.nada.kth.se/lectures/ | | | | | | | | | | |
|  | http://www2.latech.edu/ | | | | | | | | | | |

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| **MAPPING TABLE** | | | | | | |
| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **3** | **2** | **2** | **2** |
| **CO2** | **2** | **3** | **3** | **3** | **3** | **2** |
| **CO3** | **2** | **2** | **3** | **3** | **3** | **3** |
| **CO4** | **3** | **2** | **2** | **3** | **3** | **3** |
| **CO5** | **3** | **3** | **3** | **3** | **3** | **3** |
| **Weightage of course contributed to each PSO** | **13** | **12** | **14** | **14** | **14** | **13** |

**software engineering Lab**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
| **CC10** | | **0** | **0** | **5** | **V** | **4** | **5** | **25** | **75** | | **100** |
| **Learning Objectives** | | | | | | | | | | | |
| **LO1** | To Impart Practical Training in Software Engineering | | | | | | | | | | |
| **LO2** | To understand about different Software Testing | | | | | | | | | | |
| **LO3** | Learn to write test cases using different testing techniques. | | | | | | | | | | |
| **List of Exercises** | | | | | | | | | | | |
| **Do the following 8 exercises for any project projects (Eg. Student Portal, Online exam registration)**  1) Development of problem statement.  2) Preparation of Software Requirement Specification Document.  3)Preparation of Software Configuration Management and Risk Management related documents.  4) Draw the entity relationship diagram  5) Draw the data flow diagrams at level 0 and level 1  6) Draw use case diagram  7) Draw activity diagram of all use cases.  8) Performing the Design by using any Design phase CASE tools.  9) Develop test cases for unit testing and integration testing  10) Develop test cases for various white box and black box testing techniques | | | | | | | | | | | |
| **TOTAL** | | | | | | | | | | **75** | |
| **CO** | **Course Outcomes** | | | | | | | | | | |
| CO1 | An ability to use the methodology and tools necessary for engineering practice. | | | | | | | | | | |
| CO2 | Ability to elicit, analyze and specify software requirements. | | | | | | | | | | |
| CO3 | Analyze and translate specifications into a design. | | | | | | | | | | |
| CO4 | Ability to derive test cases for different testing. | | | | | | | | | | |
| CO5 | Apply software engineering perspective through requirements analysis, software design and construction, verification, and validation to develop solutions to modern problems | | | | | | | | | | |

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| **MAPPING TABLE** | | | | | | |
| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **3** | **2** | **2** | **2** |
| **CO2** | **2** | **3** | **3** | **3** | **3** | **2** |
| **CO3** | **2** | **2** | **3** | **3** | **3** | **3** |
| **CO4** | **3** | **2** | **2** | **3** | **3** | **3** |
| **CO5** | **3** | **3** | **3** | **3** | **3** | **3** |
| **Weightage of course contributed to each PSO** | **13** | **12** | **14** | **14** | **14** | **13** |

**SOFTWARE METRICS**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
|  | | **5** | **0** | **0** | **-** | **4** | **5** | **25** | **75** | | **100** |
| **Learning Objectives** | | | | | | | | | | | |
| **LO1** | Gain a solid understanding of what software metrics are and their significance | | | | | | | | | | |
| **LO2** | Learn how to identify and select appropriate software metrics based on project goals | | | | | | | | | | |
| **LO3** | Acquire knowledge and skills in collecting and measuring software metrics | | | | | | | | | | |
| **LO4** | Learn how to analyze and interpret software metrics data to extract valuable insights | | | | | | | | | | |
| **LO5** | Gain the ability to evaluate software quality using appropriate metrics | | | | | | | | | | |
| **Unit** | **Contents** | | | | | | | | | **No. of Hours** | |
| I | *Fundamentals of Measurement: Need for* Measurement: Measurement in Software Engineering, Scope of Software Metrics, *The Basics of measurement*: The representational theory of measurement, Measurement and models, Measurement scales and scale types, meaningfulness in measurement | | | | | | | | | **15** | |
| II | *A Goal-Based Framework For Software Measurement:* Classifyingsoftware measures, Determining what to Measure, Applying the framework, Software measurement validation, Performing SoftwareMeasurementValidation  *Empirical investigation*: Principles of Empirical Studies, PlanningExperiments, Planning case studies as quasi-experiments, Relevant and Meaningful Studies | | | | | | | | | **15** | |
| III | *Software Metrics Data Collection:* Defining good data, Data collection for incident reports, How to collect data, Reliability of data collection Procedures *Analyzing software measurement data:* Statistical distributions andhypothesis testing, Classical data analysis techniques, Examples of simple analysis techniques | | | | | | | | | **15** | |
| IV | *Measuring internal product attributes: Size* Properties of Software Size, Code size, Design size, Requirements analysis and Specification size, Functional size measures and estimators, Applications of size measures *Measuring internal product attributes: Structure:* Aspects of Structural Measures, Control flow structure of program units, Design-levelAttributes, Object-oriented Structural attributes and measures | | | | | | | | | **15** | |
| V | *Measuring External Product Attributes:* Modelling software quality,Measuring aspects of quality, Usability Measures, Maintainabilitymeasures,SecurityMeasures *Software Reliability: Measurement and Prediction:* Basics of reliability theory, The software reliability problem, Parametric reliability growth models, Predictive accuracy | | | | | | | | | **15** | |
| **TOTAL** | | | | | | | | | | **75** | |
| **CO** | **Course Outcomes** | | | | | | | | | | |
| CO1 | Understand various fundamentals of measurement and software metrics | | | | | | | | | | |
| CO2 | Identify frame work and analysis techniques for software measurement | | | | | | | | | | |
| CO3 | Apply internal and external attributes of software product for effort estimation | | | | | | | | | | |
| CO4 | Use appropriate analytical techniques to interpret software metrics data and derive meaningful insights | | | | | | | | | | |
| CO5 | Recommend reliability models for predicting software quality | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | |
|  | Software Metrics A Rigorous and Practical Approach, Norman Fenton, James Bieman , Third Edition, 2014 | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
| 1 | Software metrics, Norman E, Fenton and Shari Lawrence Pfleeger, International Thomson Computer Press, 1997 | | | | | | | | | | |
| 2 | Metric and models in software quality engineering, Stephen H.Kan, Second edition, 2002, Addison Wesley Professional | | | | | | | | | | |
| 3 | Practical Software Metrics for Project Management and Process Improvement, Robert B.Grady, 1992, Prentice Hall. | | | | | | | | | | |
| **NOTE: Latest Edition of Textbooks May be Used** | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | |
| 1. | https://lansa.com/blog/general/what-are-software-metrics-how-can-i-measure-these-metrics/ | | | | | | | | | | |
| 2. | https://stackify.com/track-software-metrics/ | | | | | | | | | | |

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| **MAPPING TABLE** | | | | | | |
| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **2** | **2** | **2** | **2** |
| **CO2** | **2** | **3** | **3** | **3** | **3** | **2** |
| **CO3** | **2** | **2** | **3** | **3** | **3** | **3** |
| **CO4** | **3** | **2** | **2** | **3** | **2** | **3** |
| **CO5** | **3** | **3** | **3** | **2** | **3** | **3** |
| **Weightage of course contributed to each PSO** | **13** | **12** | **13** | **13** | **13** | **13** |

**MACHINE LEARNING**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
|  | | **5** | **0** | **0** | **-** | **4** | **5** | **25** | **75** | | **100** |
| **Learning Objectives** | | | | | | | | | | | |
| **LO1** | To  comprehend the raw  data and to design the same  with the appropriate machine learning algorithms for a meaningful representation of data.. | | | | | | | | | | |
| **Unit** | **Contents** | | | | | | | | | **No. of Hours** | |
| I | **Introduction:** Machine Learning – Examples of Machine Learning Applications. **Supervised Learning:** Learning a Class from Examples – Vapnik-Chervonenkis (VC) Dimension – Probably Approximately Correct (PAC) Learning – Noise – Learning Multiple Classes – Regression – Model Selection and Generalization – Dimensions of a Supervised Machine Learning Algorithm. **Bayesian Decision Theory:** Introduction – Classification – Losses and Risks – Discriminant Functions – Association Rules. | | | | | | | | | **15** | |
| II | **Parametric Methods:** Maximum Likelihood Estimation – Evaluating an Estimator: Bias and Variance – The Bayes’ Estimator – Parametric Classification – Regression – Tuning Model Complexity: Bias/Variance Dilemma – Model Selection Procedures. **Nonparametric Methods:** Nonparametric Density Estimation – Generalization to Multivariate Data – Nonparametric Classification – Condensed Nearest Neighbor – Distance-Based Classification – Outlier Detection – Nonparametric Regression: Smoothing Models | | | | | | | | | **15** | |
| III | **Linear Discrimination** – Generalizing the Linear Model – Geometry of the Linear Discriminant – Pairwise Separation – Gradient Descent – Logistic Discrimination – Discrimination by Regression – Learning to Rank. **Multilayer Perceptrons:** The Perceptron – Training a Perceptron – Learning Boolean Functions  – Multilayer Perceptrons – MLP as a Universal Approximator – Backpropagation Algorithm | | | | | | | | | **15** | |
| IV | **Combining Multiple Learners:** Generating Diverse Learners – Model Combination Schemes – Voting – Bagging – Boosting – Stacked Generalization – Fine-Tuning an Ensemble – Cascading Reinforcement Learning: Elements of Reinforcement Learning – Model-Based Learning – Temporal Difference Learning – Generalization – Partially Observable States | | | | | | | | | **15** | |
| V | **Machine Learning with Python**: Data Pre-processing, Analysis & Visualization - Training Data and Test Data – Techniques – Algorithms: List of Common Machine Learning Algorithms- Decision Tree Algorithm- Naïve Bayes Algorithm - K-Means-Random Forest- Dimensionality Reduction Algorithm- Boosting Algorithms – Applications: Social Media-Refinement of Search Engine Results- Product Recommendations-Detection of Online frauds. | | | | | | | | | **15** | |
| **TOTAL** | | | | | | | | | | **75** | |
| **CO** | **Course Outcomes** | | | | | | | | | | |
| CO1 | Outline the importance of machine learning in terms of designing intelligent machines | | | | | | | | | | |
| CO2 | Identify suitable machine learning techniques for the real time applications | | | | | | | | | | |
| CO3 | Analyze the theoretical concepts and how they relate to the practical aspects of machine learning. | | | | | | | | | | |
| CO4 | Assess the significance of principles, algorithms and applications of machine learning through a hands-on approach | | | | | | | | | | |
| CO5 | Compare the machine learning techniques with respective functionality | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | |
|  | Ethem Alpaydın, “Introduction to Machine Learning” Third Edition, MIT, 2014. (Unit I – Unit IV)  https://www.tutorialspoint.com/machine\_learning\_with\_python/machine\_learning\_with\_python\_tutorial.pdf (**Unit V:** Machine learning with python tutorial) | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
|  | Bertt Lantz, "Machine Learning with R," Packt Publishing, 2013 | | | | | | | | | | |
|  | Jason Bell, "Machine Learning: Hands-On for Developers and Technical Professionals," Wiley Publication, 2015. | | | | | | | | | | |
| **NOTE: Latest Edition of Textbooks May be Used** | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | |
|  | 1. https://www.expertsystem.com/machine-learning-definition/ | | | | | | | | | | |
| . | 1. https://searchenterpriseai.techtarget.com/definition/machine-learning-ML | | | | | | | | | | |

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| **MAPPING TABLE** | | | | | | |
| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **2** | **2** | **2** | **2** |
| **CO2** | **2** | **3** | **3** | **3** | **3** | **2** |
| **CO3** | **2** | **2** | **3** | **3** | **3** | **3** |
| **CO4** | **3** | **2** | **2** | **3** | **2** | **3** |
| **CO5** | **3** | **3** | **3** | **2** | **3** | **3** |
| **Weightage of course contributed to each PSO** | **13** | **12** | **13** | **13** | **13** | **13** |

**NETWORK SECURITY**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | | **External** | **Total** |
|  | | - | 5 | - | - | 4 | 5 | 25 | | 75 | 100 |
| **Learning Objectives** | | | | | | | | | | | |
| LO1 | To familiarize on the model of network security, Encryption techniques | | | | | | | | | | |
| LO2 | To understand the design concept of cryptography and authentication | | | | | | | | | | |
| LO3 | To develop experiments on algorithm used for security | | | | | | | | | | |
| LO4 | To understand about virus and threats, firewalls, and implementation of Cryptography | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | | **No. of Hours** | | |
| I | Model of network security – Security attacks, services and attacks – OSI security architecture – Classical encryption techniques – SDES – Block cipher PrinciplesDES – Strength of DES – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – RC4 - Differential and linear cryptanalysis – Placement of encryption function – traffic confidentiality. | | | | | | | | 15 | | |
| II | Number Theory – Prime number – Modular arithmetic – Euclid’s algorithm - Fermet’s and Euler’s theorem – Primality – Chinese remainder theorem – Discrete logarithm – Public key cryptography and RSA – Key distribution – Key management – Diffie Hellman key exchange – Elliptic curve cryptography | | | | | | | | 15 | | |
| III | Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS. | | | | | | | | 15 | | |
| IV | Authentication applications – Kerberos – X.509 Authentication services - E- mail security – IP security - Web security | | | | | | | | 15 | | |
| V | Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security | | | | | | | | 15 | | |
|  | **Total** | | | | | | | | **75** | | |
| **Course Outcomes** | | | | | | | | | | | |
| **Course Outcomes** | On completion of this course, students will; | | | | | | | | | | |
| **CO1** | Understand public-key cryptography, RSA and other public-key cryptosystems such as Diffie-Hellman Key Exchange, ElGamal Cryptosystem. | | | | | | | | | | |
| **CO2** | Understand the security issues. | | | | | | | | | | |
| **CO3** | Apply key management and distribution schemes design. User Authentication | | | | | | | | | | |
| **CO4** | Analyze and design hash and MAC algorithms, and digital signatures. Analyze and design classical encryption techniques and block ciphers. | | | | | | | | | | |
| **CO5** | Assess Intruders and Intruder Detection mechanisms, Types of Malicious software, | | | | | | | | | | |
| **Reference Text :** | | | | | | | | | | | |
| 1. | William Stallings, “Cryptography & Network Security”, Pearson Education, Fourth Edition 2010. | | | | | | | | | | |
| **References :** | | | | | | | | | | | |
| 1. | CharlieKaufman,RadiaPerlman,MikeSpeciner,“NetworkSecurity,Privatecommunicationinpublicworld”,PHISecondEdition,2002 | | | | | | | | | | |
| 2. | Bruce Schneier, Neils Ferguson, “Practical Cryptography”, Wiley Dreamtech India Pvt Ltd, First Edition, 2003. | | | | | | | | | | |
| 3. | DouglasRSimson“Cryptography–Theoryandpractice”,CRCPress,FirstEdition,1995 | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | |
| 1. | <https://www.javatpoint.com/computer-network-security> | | | | | | | | | | |
| 2. | <https://www.tutorialspoint.com/information_security_cyber_law/network_security.htm> | | | | | | | | | | |
| 3. | <https://www.geeksforgeeks.org/network-security/> | | | | | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **MAPPING TABLE** | | | | | | |
| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **2** | **2** | **2** | **2** |
| **CO2** | **2** | **3** | **3** | **3** | **3** | **2** |
| **CO3** | **2** | **2** | **3** | **3** | **3** | **3** |
| **CO4** | **3** | **2** | **2** | **3** | **2** | **3** |
| **CO5** | **3** | **3** | **3** | **2** | **3** | **3** |
| **Weightage of course contributed to each PSO** | **13** | **12** | **13** | **13** | **13** | **13** |

**MOBILE APPLICATION DEVELOPMENT**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | **Total** | |
|  | | | **5** | **0** | **0** | **-** | **4** | **5** | **25** | **75** | **100** | |
| **Learning Objectives** | | | | | | | | | | | | |
| **LO1** | | To provide the students with the basics of Android Software Development tools and development of software on mobile platform. | | | | | | | | | | |
| **Unit** | | **Contents** | | | | | | | | | | **No. of Hours** |
| I | | Introduction to Android Operating System – Configuration of Android Environment- Create the First Android Application. Layout: Vertical, Vertical Scroll, horizontal, horizontal Scroll, Table Layout arrangement. Designing User Interface: Label Text - TextView – Password Text Box - Button –ImageButton – CheckBox – Image - RadioButton – Slider – Autocomplete text View. | | | | | | | | | | **15** |
| II | | User Interface: Spinner – Switch – Side Bar- ListView - List Picker - Image Picker - Notifier - Time and Date Picker - Web Viewer | | | | | | | | | | **15** |
| III | | Media: Camcorder - Camera – Player – Speech Recognizer – Text to Speech – Video Player – Canvas | | | | | | | | | | **15** |
| IV | | Maps: Maps - Sensor: Location Sensor – Barcode Scanner Social components: Contact Picker – Email Picker – Phone Number Picker – Phone Call - Social: Texting | | | | | | | | | | **15** |
| V | | Storage: Cloud DB – Tiny DB – Experimental – Fire DB | | | | | | | | | | **15** |
| **TOTAL** | | | | | | | | | | | | **75** |
| **CO** | | **Course Outcomes** | | | | | | | | | | |
| CO1 | | Chart the requirements needed for developing android application | | | | | | | | | | |
| CO2 | | Identify the results by executing the application in emulator or in android device | | | | | | | | | | |
| CO3 | | Apply proper interface setup, styles & themes, storing and management | | | | | | | | | | |
| CO4 | | Analyze the problem and add necessary user interface components, graphics and multimedia components into the application. | | | | | | | | | | |
| CO5 | | Evaluate the results by implementing the concept behind the problem with proper code. | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | | |
|  | | Karen Lang and Selim Tezel, (2022), Become an App Inventor The official guide from MIT App Inventor, Miteen Press, Walker Books Limited. | | | | | | | | | | |
| Reference Books | | | | | | | | | | | | |
| 1 | Wei – Meng Lee, (2012), Beginning Android 4 Application Development, Wiley India Edition. | | | | | | | | | | | |
| 2 | Deital, Android for Programmers-An App-Driven Approach,Second Edition. | | | | | | | | | | | |
| 3 |  | | | | | | | | | | | |
| **NOTE: Latest Edition of Textbooks May be Used** | | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | |
|  | | http://ai2.appinventor.mit.edu/reference/ | | | | | | | | | | |
| . | | http://appinventor.mit.edu/explore/paint-pot-extended-camera | | | | | | | | | | |

**Elective course – (EC1-EC8)-Discipline Specific Syllabus**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Marks** | | | | |
| **CIA** | | **External** | | **Total** |
|  | NATURAL LANGUAGE PROCESSING | **Elect** | 4 | - | - |  | 3 | 25 | | 75 | | 100 |
| **Learning Objectives** | | | | | | | | | | | | |
| **LO1** | To understand approaches to syntax and semantics in NLP. | | | | | | | | | | | |
| **LO2** | To learn natural language processing and to learn how to apply basic algorithms in this field. | | | | | | | | | | | |
| **LO3** | To understand approaches to discourse, generation, dialogue and summarization within NLP. | | | | | | | | | | | |
| **LO4** | Toget acquainted with the algorithmic description of the main language levels: morphology, syntax, semantics, pragmatics etc. | | | | | | | | | | | |
| **LO5** | To understand current methods for statistical approaches to machine translation. | | | | | | | | | | | |
| **UNIT** | **Contents** | | | | | | | | | | **No. Of. Hours** | |
| I | **Introduction :** Natural Language Processing tasks in syntax, semantics, and pragmatics – Issue- Applications – The role of machine learning – Probability Basics –Information theory – Collocations -N-gram Language Models – Estimating parameters and smoothing – Evaluating language models. | | | | | | | | | | **12** | |
| II | **Word level and Syntactic Analysis:**Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging.Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing. | | | | | | | | | | **12** | |
| III | **Semantic analysis and Discourse Processing:** Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure. | | | | | | | | | | **12** | |
| IV | **Natural Language Generation:** Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation. Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages. | | | | | | | | | | **12** | |
| V | **Information retrieval and lexical resources:** Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: WorldNet-Frame NetStemmers- POS Tagger- Research Corpora SSAS. | | | | | | | | | | **12** | |
| **Course Outcomes** | | | | | | | | | **Programme Outcomes** | | | |
| CO | On completion of this course, students will | | | | | | | |  | | | |
| CO1 | Describe the fundamental concepts and techniques of natural language processing.  Explain the advantages and disadvantages of different NLP technologies and their applicability in different business situations. | | | | | | | | | | | |
| CO2 | Distinguish among the various techniques, taking into account the assumptions, strengths, and weaknesses of each   |  | | --- | | Use NLP technologies to explore and gain a broad understanding  of text data. | | | | | | | | | | | | |
| CO3 | Use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions.  Use NLP methods to analyse sentiment of a text document. | | | | | | | | | | | |
| CO4 | Analyze large volume text data generated from a range of real-world applications.  Use NLP methods to perform topic modelling. | | | | | | | | | | | |
| CO5 | Develop robotic process automation to manage business processes and to increase and monitor their efficiency and effectiveness.  Determine the framework in which artificial intelligence and the Internet of things may function, including interactions with people, enterprise functions, and environments. | | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | | |
| 1 | Daniel Jurafsky, James H. Martin, “Speech & language processing”, Pearson publications. | | | | | | | | | | | |
| 2 | Allen, James. Natural language understanding. Pearson, 1995. | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | |
| 1. | Pierre M. Nugues, “An Introduction to Language Processing with Perl and Prolog”,Springer | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | |
| 1. | https://en.wikipedia.org/wiki/Natural\_language\_processing | | | | | | | | | | | |
| 2. | https://www.techtarget.com/searchenterpriseai/definition/natural-language-processing-NLP | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO 1** | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 2** | 2 | 3 | 3 | 3 | 2 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 4** | 3 | 2 | 3 | 3 | 2 | 3 |
| **CO 5** | 3 | 3 | 3 | 3 | 3 | 3 |
| **Weightageof coursecontributedtoeachPSO** | 14 | 14 | 15 | 15 | 13 | 15 |

**ANALYTICS FOR SERVICE INDUSTRY**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Category** | | **L** | **T** | **P** | **S** | **Credits** | **Marks** | | | | |
| **CIA** | **External** | | **Total** | |
|  | **Elect** | | 4 | - | - | - | 3 | 25 | 75 | | 100 | |
| **Learning Objectives** | | | | | | | | | | | | |
| **LO1** | Recognize challenges in dealing with data sets in service industry. | | | | | | | | | | | |
| **LO2** | Identify and apply appropriate algorithms for analyzing the healthcare, Human resource, hospitality and tourism data. | | | | | | | | | | | |
| **LO3** | Make choices for a model for new machine learning tasks. | | | | | | | | | | | |
| **LO4** | To identify employees with high attrition risk. | | | | | | | | | | | |
| **LO5** | To Prioritizing various talent management initiatives for your organization. | | | | | | | | | | | |
| **UNIT** | **Contents** | | | | | | | | | **No. Of. Hours** | | |
| I | **Healthcare Analytics :** Introduction to Healthcare Data Analytics- Electronic Health Records– Components of EHR- Coding Systems- Benefits of EHR- Barrier to Adopting HER Challenges-Phenotyping Algorithms. Biomedical Image Analysis and Signal Analysis- Genomic Data Analysis for Personalized Medicine. Review of Clinical Prediction Models. | | | | | | | | | **12** | | |
| II | **Healthcare Analytics Applications :** Applications and Practical Systems for Healthcare– Data Analytics for Pervasive Health- Fraud Detection in Healthcare- Data Analytics for Pharmaceutical Discoveries- Clinical Decision Support Systems- Computer- Assisted Medical Image Analysis Systems- Mobile Imaging and Analytics for Biomedical Data. | | | | | | | | | **12** | | |
| III | **HR Analytics:** Evolution of HR Analytics, HR information systems and data sources, HR Metric and HR Analytics, Evolution of HR Analytics; HR Metrics and HR Analytics; Intuition versus analytical thinking; HRMS/HRIS and data sources; Analytics frameworks like LAMP, HCM:21(r) Model. | | | | | | | | | **12** | | |
| IV | **Performance Analysis:** Predicting employee performance, Training requirements, evaluating training and development, Optimizing selection and promotion decisions. | | | | | | | | | **12** | | |
| V | **Tourism and Hospitality Analytics:** Guest Analytics – Loyalty Analytics – Customer Satisfaction – Dynamic Pricing – optimized disruption management – Fraud detection in payments. | | | | | | | | | **12** | | |
| **TOTAL HOURS** | | | | | | | | | | **60** | | |
| **Course Outcomes** | | | | | | | | | | | |  |
| CO | | On completion of this course, students will | | | | | | | | | |  |
| CO1 | | Understand and critically apply the concepts and methods of business analytics | | | | | | | | | |  |
| CO2 | | Identify, model and solve decision problems in different settings. | | | | | | | | | |  |
| CO3 | | Interpret results/solutions and identify appropriate courses of action for a given managerial situation whether a problem or an opportunity. | | | | | | | | | |  |
| CO4 | | Create viable solutions to decision making problems. | | | | | | | | | |  |
| CO5 | | Instill a sense of ethical decision-making and a commitment to the long-run welfare of both organizations and the communities they serve. | | | | | | | | | |  |
| **Textbooks** | | | | | | | | | | | | |
| 1 | | Chandan K. Reddy and Charu C Aggarwal, “Healthcare data analytics”, Taylor & Francis, 2015. | | | | | | | | | | |
| 2 | | Edwards Martin R, Edwards Kirsten (2016),“Predictive HR Analytics: Mastering the HR Metric”, Kogan Page Publishers, ISBN-0749473924 | | | | | | | | | | |
| 3 | | Fitz-enzJac (2010), “The new HR analytics: predicting the economic value of your company’s human capital investments”, AMACOM, ISBN-13: 978-0-8144-1643-3 | | | | | | | | | | |
| 4 | | RajendraSahu, Manoj Dash and Anil Kumar. Applying Predictive Analytics Within the Service Sector. | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | |
| 1. | | Hui Yang and Eva K. Lee, “Healthcare Analytics: From Data to Knowledge to Healthcare Improvement, Wiley, 2016 | | | | | | | | | | |
| 2. | | Fitz-enzJac, Mattox II John (2014), “Predictive Analytics for Human Resources”, Wiley, ISBN- 1118940709. | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | |
| 1. | | https://www.ukessays.com/essays/marketing/contemporary-issues-in-marketing-marketing-essay.php | | | | | | | | | | |
| 2. | | https://yourbusiness.azcentral.com/examples-contemporary-issues-marketing-field-26524.html | | | | | | | | | | |

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO 1** | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 2** | 2 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 2 | 3 | 3 | 2 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 5** | 3 | 3 | 3 | 3 | 3 | 3 |
| **Weightageof coursecontributedtoeachPSO** | 14 | 15 | 14 | 15 | 15 | 14 |

S-Strong-3 M-Medium-2 L-Low-1

**CRYPTOGRAPHY**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Marks** | | | | |
| **CIA** | | **External** | | **Total** |
|  | | **Elect** | 4 | - | - | - | 3 | 25 | | 75 | | 100 |
| **Learning Objectives** | | | | | | | | | | | | |
| LO1 | To understand the fundamentals of Cryptography | | | | | | | | | | | |
| LO2 | To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity. | | | | | | | | | | | |
| LO3 | To understand the various key distribution and management schemes. | | | | | | | | | | | |
| LO4 | To understand how to deploy encryption techniques to secure data in transit across data networks | | | | | | | | | | | |
| LO5 | To design security applications in the field of Information technology | | | | | | | | | | | |
| **UNIT** | **Contents** | | | | | | | | | | **No. Of. Hours** | |
| I | **Introduction:** The OSI security Architecture – Security Attacks – Security Mechanisms – Security Services – A model for network Security. | | | | | | | | | | **12** | |
| II | **Classical Encryption Techniques:** Symmetric cipher model – **Substitution Techniques:** Caesar Cipher – Monoalphabetic cipher – Play fair cipher – Poly Alphabetic Cipher – Transposition techniques – Stenography | | | | | | | | | | **12** | |
| III | **Block Cipher and DES:** Block Cipher Principles – DES – The Strength of DES –**RSA:** The RSA algorithm. | | | | | | | | | | **12** | |
| IV | **Network Security Practices**: IP Security overview - IP Security architecture – Authentication Header. **Web Security**: SecureSocket Layer and Transport Layer Security – Secure Electronic Transaction. | | | | | | | | | | **12** | |
| V | Intruders – Malicious software – Firewalls. | | | | | | | | | | **12** | |
| **TOTAL HOURS** | | | | | | | | | | | **60** | |
| **Course Outcomes** | | | | | | | | | **Programme Outcomes** | | | |
| CO | On completion of this course, students will | | | | | | | |  | | | |
| CO1 | Analyze the vulnerabilities in any computing system and hence be able to design a security solution. | | | | | | | | PO1, PO2, PO3, PO4, PO5, PO6 | | | |
| CO2 | Apply the different cryptographic operations of symmetric cryptographic algorithms | | | | | | | | PO1, PO2, PO3, PO4, PO5, PO6 | | | |
| CO3 | Apply the different cryptographic operations of public key cryptography | | | | | | | | PO1, PO2, PO3, PO4, PO5, PO6 | | | |
| CO4 | Apply the various Authentication schemes to simulate different applications. | | | | | | | | PO1, PO2, PO3, PO4, PO5, PO6 | | | |
| CO5 | Understand various Security practices and System security standards | | | | | | | | PO1, PO2, PO3, PO4, PO5, PO6 | | | |
| **Textbooks** | | | | | | | | | | | | |
| 1 | **William Stallings,** “Cryptography and Network Security Principles andPractices”. | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | |
| 1. | **Behrouz A. Foruzan,** “Cryptography and Network Security”, Tata McGraw-Hill, 2007. | | | | | | | | | | | |
| 2 | **AtulKahate**, “*Cryptography and Network Security*”, Second Edition, 2003,TMH. | | | | | | | | | | | |
| 3 | **M.V. Arun Kumar**, “*NetworkSecurity*”, 2011, First Edition,USP. | | | | | | | | | | | |
|  | **Web Resources** | | | | | | | | | | | |
| 1 | https:[//www.tutorialspoint.com/cryptography/](http://www.tutorialspoint.com/cryptography/) | | | | | | | | | | | |
| 2 | https://gpgtools.tenderapp.com/kb/how-to/introduction-to-cryptography | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO 1** | 3 | 3 | 3 | 2 | 3 | 2 |
| **CO 2** | 3 | 2 | 3 | 2 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 2 | 3 | 3 |
| **CO 4** | 2 | 3 | 3 | 3 | 2 | 3 |
| **CO 5** | 3 | 2 | 3 | 3 | 3 | 3 |
| **Weightage of course contributed to each PSO** | 14 | 13 | 15 | 12 | 14 | 14 |

**BIG DATA ANALYTICS**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | **Total** | |
|  | Core | 4 | - | - | - | 3 | 5 | 25 | 75 | 100 | |
| **Course Objective** | | | | | | | | | | | |
| C1 | Understand the Big Data Platform and its Use cases, Map Reduce Jobs | | | | | | | | | | |
| C2 | To identify and understand the basics of cluster and decision tree | | | | | | | | | | |
| C3 | To study about the Association Rules, Recommendation System | | | | | | | | | | |
| C4 | To learn about the concept of stream | | | | | | | | | | |
| C5 | Understand the concepts of NoSQL Databases | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | | | **No. of Hours** | |
| I | Evolution of Big data — Best Practices for Big data Analytics — Big data characteristics — Validating — The Promotion of the Value of Big Data — Big Data Use Cases- Characteristics of Big Data Applications — Perception and Quantification of Value -Understanding Big Data Storage — A General Overview of High-Performance Architecture — HDFS — MapReduce and YARN — Map Reduce Programming Model | | | | | | | | | 12 | |
| II | Advanced Analytical Theory and Methods: Overview of Clustering — K-means — Use Cases — Overview of the Method — Determining the Number of Clusters — Diagnostics — Reasons to Choose and Cautions .- Classification: Decision Trees — Overview of a Decision Tree — The General Algorithm — Decision Tree Algorithms — Evaluating a Decision Tree — Decision Trees in R — Naïve Bayes — Bayes? Theorem — Naïve Bayes Classifier. | | | | | | | | | 12 | |
| III | Advanced Analytical Theory and Methods: Association Rules — Overview — Apriori Algorithm — Evaluation of Candidate Rules — Applications of Association Rules — Finding Association& finding similarity — Recommendation System: Collaborative Recommendation- Content Based Recommendation — Knowledge Based Recommendation- Hybrid Recommendation Approaches. | | | | | | | | | 12 | |
| IV | Introduction to Streams Concepts — Stream Data Model and Architecture — Stream Computing,Sampling Data in a Stream — Filtering Streams — Counting Distinct Elements in a Stream — Estimating moments — Counting oneness in a Window — Decaying Window — Real time Analytics Platform(RTAP) applications — Case Studies — Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics | | | | | | | | | 12 | |
| V | NoSQL Databases : Schema-less Models?: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores — Tabular Stores — Object Data Stores — Graph Databases Hive — Sharding —Hbase — Analyzing big data with twitter — Big data for E-Commerce Big data for blogs — Review of Basic Data Analytic Methods using R. | | | | | | | | | 12 | |
|  | **Total** | | | | | | | | | **60** | |
| **Course Outcomes** | | | | | | | | | | |  |
| CO | On completion of this course, students will | | | | | | | | | |  |
| 1 | Work with big data tools and its analysis techniques. | | | | | | | | | |  |
| 2 | Analyze data by utilizing clustering and classification algorithms. | | | | | | | | | |  |
| 3 | Learn and apply different mining algorithms and recommendation systems for large volumes of data. | | | | | | | | | |  |
| 4 | Perform analytics on data streams. | | | | | | | | | |  |
| 5 | Learn NoSQL databases and management. | | | | | | | | | |  |
| **Text Book** | | | | | | | | | | | |
| 1 | AnandRajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012. | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
| 1. | David Loshin, “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph”, Morgan Kaufmann/El sevier Publishers, 2013 | | | | | | | | | | |
| 2. | EMC Education Services, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley publishers, 2015. | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | |
| 1. | <https://www.simplilearn.com> | | | | | | | | | | |
| 2. | <https://www.sas.com/en_us/insights/analytics/big-data-analytics.html> | | | | | | | | | | |

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO 1** | 3 | 3 | 3 | 2 | 3 | 2 |
| **CO 2** | 3 | 2 | 3 | 2 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 2 | 3 | 3 |
| **CO 4** | 2 | 3 | 3 | 3 | 2 | 3 |
| **CO 5** | 3 | 2 | 3 | 3 | 3 | 3 |
| **Weightage of course contributed to each PSO** | 14 | 13 | 15 | 12 | 14 | 14 |

**S-Strong M-Medium L-Low**

**INTERNET OF THINGS AND ITS APPLICATIONS**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | | **Credits** | **Inst. Hours** | | **Marks** | | |
| **CIA** | **External** | **Total** | |
|  |  | Core | Y | - | - | - | | 3 | 4 | | 25 | 75 | 100 | |
| **Course Objective** | | | | | | | | | | | | | |
| C1 | Use of Devices, Gateways and Data Management in IoT. | | | | | | | | | | | | |
| C2 | Design IoT applications in different domain and be able to analyze their performance | | | | | | | | | | | | |
| C3 | Implement basic IoT applications on embedded platform | | | | | | | | | | | | |
| C4 | To gain knowledge on Industry Internet of Things | | | | | | | | | | | | |
| C5 | To Learn about the privacy and Security issues in IoT | | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | **No. of Hours** | | | | **Course Objective** | | |
| I | IoT & Web Technology, The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics. | | | | | | 12 | | | | C1 | | |
| II | M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. | | | | | | 12 | | | | C2 | | |
| III | **:** IoT Architecture -State of the Art – Introduction, State of the art, Architecture. Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views | | | | | | 12 | | | | C3 | | |
| IV | IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and GasIndustry, Opinions on IoT Application and Value for Industry, Home Management | | | | | | 12 | | | | C4 | | |
| V | Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security | | | | | | 12 | | | | C5 | | |
|  | **Total** | | | | | | **60** | | | |  | | |
| **Course Outcomes** | | | | | | | | | | **Programme Outcomes** | | | |
| CO | On completion of this course, students will | | | | | | | | |  | | | |
| 1 | Work with big data tools and its analysis techniques. | | | | | | | | | PO1 | | | |
| 2 | Analyze data by utilizing clustering and classification algorithms. | | | | | | | | | PO1, PO2 | | | |
| 3 | Learn and apply different mining algorithms and recommendation systems for large volumes of data. | | | | | | | | | PO4, PO6 | | | |
| 4 | Perform analytics on data streams. | | | | | | | | | PO4, PO5, PO6 | | | |
| 5 | Learn NoSQL databases and management. | | | | | | | | | PO3, PO8 | | | |
| **Text Book** | | | | | | | | | | | | | |
| 1 | Vijay Madisetti and Arshdeep Bahga, “Internet of Things: (A Hands-on Approach)”, Universities Press (INDIA) Private Limited 2014, 1st Edition. | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | |
| 1. | Michael Miller, “The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World”, kindle version. | | | | | | | | | | | | |
| 2. | Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, Apress Publications 2013, 1st Edition,. | | | | | | | | | | | | |
| 3 | WaltenegusDargie, ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice” 4..CunoPfister, “Getting Started with the Internet of Things”, O‟Reilly Media 2011 | | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | | |
| 1. | <https://www.simplilearn.com> | | | | | | | | | | | | |
| 2. | https://www.javatpoint.com | | | | | | | | | | | | |
| 3. | https://www.w3schools.com | | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | S |  |  |  |  |  |  |  |
| **CO 2** | M | S |  |  |  |  |  |  |
| **CO 3** |  |  |  | S |  | S |  |  |
| **CO 4** |  |  |  | S | S | M |  |  |
| **CO 5** |  |  | S |  |  |  |  | S |

**S-Strong M-Medium L-Low**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Human Computer Interaction** | Elective | - | Y | - | V | | 3 | 4 | 25 | 75 | 100 |
| **Course Objective** | | | | | | | | | | | | |
| C1 | To learn about the foundations of Human Computer Interaction. | | | | | | | | | | | |
| C2 | To learn the design and software process technologies. | | | | | | | | | | | |
| C3 | To learn HCI models and theories. | | | | | | | | | | | |
| C4 | To learn Mobile Ecosystem. | | | | | | | | | | | |
| C5 | To learn the various types of Web Interface Design. | | | | | | | | | | | |
|  |  | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | | | | **No. of Hours** | |
| I | **FOUNDATIONS OF HCI :**   * The Human: I/O channels – Memory * Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; * Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies | | | | | | | | | | 12 | |
| II | **DESIGN & SOFTWARE PROCESS:**   * Interactive Design: * Basics – process – scenarios * Navigation: screen design Iteration and prototyping. * HCI in software process: * Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design | | | | | | | | | | 12 | |
| III | **MODELS AND THEORIES:**   * HCI Models : Cognitive models:- Socio-Organizational issues and stakeholder requirements Communication and collaboration models-Hypertext, Multimedia and WWW. | | | | | | | | | | 12 | |
| IV | **Mobile HCI:**   * Mobile Ecosystem: Platforms, Application frameworks * Types of Mobile Applications: Widgets, Applications, Games * Mobile Information Architecture, Mobile 2.0, * Mobile Design: Elements of Mobile Design, Tools. - Case Studies | | | | | | | | | | 12 | |
| V | **WEB INTERFACE DESIGN:** Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies | | | | | | | | | | 12 | |
|  | **Total** | | | | | | | | | | **60** | |
| **Course Outcomes** | | | | | | | **Programme Outcome** | | | | | |
| CO | On completion of this course, students will | | | | | |  | | | | | |
| 1 | Understand the fundementals of HCI. | | | | | | PO1 | | | | | |
| 2 | Understand the design and software process technologies. | | | | | | PO1, PO2 | | | | | |
| 3 | Understand HCI models and theories. | | | | | | PO4, PO6 | | | | | |
| 4 | Understand Mobile Ecosystem, types of Mobile Applications, mobile Architecture and design. | | | | | | PO4, PO5, PO6 | | | | | |
| 5 | Understand the various types of Web Interface Design. | | | | | | PO3, PO8 | | | | | |
| **Text Book** | | | | | | | | | | | | |
| 1 | Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, ”Human -Computer Interaction‖”, III Edition, Pearson Education, 2004 (UNIT I, II & III) | | | | | | | | | | | |
| 2 | Brian Fling, ―”Mobile Design and Development”, I Edition, O‘Reilly Media Inc., 2009(UNIT–IV) | | | | | | | | | | | |
| 3 | Bill Scott and Theresa Neil, ―Designing Web Interfaces‖, First Edition, O‘Reilly, 2009. (UNIT-V) | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | |
| 1. | Shneiderman, “Designing the User Interface: Strategies for Effective Human-Computer Interaction”, V Edition, Pearson Education. | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | |
| 1. | https://www.interaction-design.org/literature/topics/human-computer-interaction | | | | | | | | | | | |
| 2. | https://link.springer.com/10.1007/978-0-387-39940-9\_192 | | | | | | | | | | | |
| 3. | https://en.wikipedia.org/wiki/Human%E2%80%93computer\_interaction | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | **S** |  |  |  |  |  |  |  |
| **CO 2** | **S** | **S** |  |  |  |  |  |  |
| **CO 3** |  |  |  | **S** |  | **S** |  |  |
| **CO 4** |  |  |  | **S** | **S** | **S** |  |  |
| **CO 5** |  |  | **S** |  |  |  |  | **S** |

**S-Strong M-Medium L-Low**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | | | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | | **External** | **Total** |
|  | **Fuzzy Logic** | Elective | Y | - | - | V | | | 3 | 4 | 25 | | 75 | 100 |
| **Course Objective** | | | | | | | | | | | | | | |
| CO1 | To understand the basic concept of Fuzzy logic | | | | | | | | | | | | | |
| CO2 | To learn the various operations on relation properties | | | | | | | | | | | | | |
| CO3 | To study about the membership functions | | | | | | | | | | | | | |
| CO4 | To learn about the Defuzzification and Fuzzy Rule-Based System | | | | | | | | | | | | | |
| CO5 | To learn the concepts of Applications of Fuzzy Logic | | | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | **No. of Hours** | | | | **Course Objective** | | |
| I | Introduction to Fuzzy Logic- Fuzzy Sets- Fuzzy Set Operations, Properties of Fuzzy Sets, Classical and Fuzzy Relations: Introduction-Cartesian Product of Relation-Classical Relations-Cardinality of Crisp Relation. | | | | | | | 12 | | | | C1 | | |
| II | Operations on Crisp Relation-Properties of Crisp Relations-Composition Fuzzy Relations, Cardinality of Fuzzy Relations-Operations on Fuzzy Relations-Properties of Fuzzy Relations-Fuzzy Cartesian Product and Composition-Tolerance and Equivalence Relations ,Crisp Relation. | | | | | | | 12 | | | | C2 | | |
| III | Membership Functions: Introduction, Features of Membership Function, Classification of Fuzzy Sets, Fuzzification, Membership Value Assignments, Intuition, Inference, Rank Ordering. | | | | | | | 12 | | | | C3 | | |
| IV | Defuzzification: Introduction, Lambda Cuts for Fuzzy Sets, Lambda Cuts for Fuzzy Relations, Defuzzification Methods, Fuzzy Rule-Based System: Introduction, Formation of Rules, Decomposition of Rules, Aggregation of Fuzzy Rules, Properties of Set of Rules. | | | | | | | 12 | | | | C4 | | |
| V | Applications of Fuzzy Logic: Fuzzy Logic in Automotive Applications, Fuzzy Antilock Brake System-Antilock-Braking System and Vehicle Speed-Estimation Using Fuzzy Logic. | | | | | | | 12 | | | | C5 | | |
|  | **Total** | | | | | | |  | | | |  | | |
| **Course Outcomes** | | | | | | | **Programme Outcomes** | | | | | | | |
| CO | On completion of this course, students will | | | | | |  | | | | | | | |
| 1 | Understand the basics of Fuzzy sets, operation and properties. | | | | | | PO1 | | | | | | | |
| 2 | Apply Cartesian product and composition on Fuzzy relations and usethe tolerance and Equivalence relations. | | | | | | PO1, PO2 | | | | | | | |
| 3 | Analyze various fuzzification methods and features of membership Functions. | | | | | | PO4, PO6 | | | | | | | |
| 4 | Evaluate defuzzification methods for real time applications. | | | | | | PO4, PO5, PO6 | | | | | | | |
| 5 | Design an application using Fuzzy logic and its Relations. | | | | | | PO3, PO8 | | | | | | | |
| **Text Book** | | | | | | | | | | | | | | |
| 1 | S. N. Sivanandam, S. Sumathi and S. N. Deepa-Introduction to Fuzzy Logic using MATLAB, Springer-Verlag Berlin Heidelberg 2007. | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | |
| 1. | Guanrong Chen and Trung Tat Pham- Introduction to Fuzzy Sets, Fuzzy Logic and Fuzzy Control Systems | | | | | | | | | | | | | |
| 2. | Timothy J Ross , Fuzzy Logic with Engineering Applications | | | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | | | |
| 1. | <https://www.javatpoint.com/fuzzy-logic> | | | | | | | | | | | | | |
| 2. | <https://www.guru99.com/what-is-fuzzy-logic.html> | | | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | S |  |  |  |  |  |  |  |
| **CO 2** | M | S |  |  |  |  |  |  |
| **CO 3** |  |  |  | S |  | S |  |  |
| **CO 4** |  |  |  | S | S | M |  |  |
| **CO 5** |  |  | S |  |  |  |  | S |

**S-Strong M-Medium L-Low**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Artificial Intelligence** | Elective | - | Y | - | - | | 3 | 4 | 25 | 75 | 100 |
| **Course Objective** | | | | | | | | | | | | |
| C1 | To learn various concepts of AI Techniques. | | | | | | | | | | | |
| C2 | To learn various Search Algorithm in AI. | | | | | | | | | | | |
| C3 | To learn probabilistic reasoning and models in AI. | | | | | | | | | | | |
| C4 | To learn about Markov Decision Process. | | | | | | | | | | | |
| C5 | To learn various type of Reinforcement learning. | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | | | | **No. of Hours** | |
| I | Introduction: Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree | | | | | | | | | | 12 | |
| II | Search Algorithms : Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A\* algorithm, Game Search | | | | | | | | | | 12 | |
| III | Probabilistic Reasoning : Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model. | | | | | | | | | | 12 | |
| IV | Markov Decision process : MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs. | | | | | | | | | | 12 | |
| V | Reinforcement Learning : Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning | | | | | | | | | | 12 | |
|  | **Total** | | | | | | | | | | **60** | |
| **Course Outcomes** | | | | | | | **Programme Outcome** | | | | | |
| CO | On completion of this course, students will | | | | | |  | | | | | |
| 1 | Understand the various concepts of AI Techniques. | | | | | | PO1 | | | | | |
| 2 | Understand various Search Algorithm in AI. | | | | | | PO1, PO2 | | | | | |
| 3 | Understand probabilistic reasoning and models in AI. | | | | | | PO4, PO6 | | | | | |
| 4 | Understand Markov Decision Process. | | | | | | PO4, PO5, PO6 | | | | | |
| 5 | Understand various type of Reinforcement learning Techniques. | | | | | | PO3, PO8 | | | | | |
| **Text Book** | | | | | | | | | | | | |
| 1 | Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach” , 3rd Edition, Prentice Hall. | | | | | | | | | | | |
|  | Elaine Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw Hill | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | |
| 1. | Trivedi, M.C., “A Classical Approach to Artifical Intelligence”, Khanna Publishing House, Delhi. | | | | | | | | | | | |
| 2. | Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, 2011 | | | | | | | | | | | |
| 3. | David Poole and Alan Mackworth, “Artificial Intelligence: Foundations for Computational Agents”, Cambridge University Press 2010 | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | |
| 1. | NPTEL&MOOCcoursestitledArtificialIntelligenceandExpertSystems | | | | | | | | | | | |
| 2. | <https://nptel.ac.in/courses/106106140/> | | | | | | | | | | | |
| 3. | <https://nptel.ac.in/courses/106106126/> | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | **S** |  |  |  |  |  |  |  |
| **CO 2** | **S** | **S** |  |  |  |  |  |  |
| **CO 3** |  |  |  | **S** |  | **S** |  |  |
| **CO 4** |  |  |  | **S** | **S** | **S** |  |  |
| **CO 5** |  |  | **S** |  |  |  |  | **S** |

**S-Strong M-Medium L-Low**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | | **Credits** | **Inst. Hours** | **Marks** | | | | |
| **CIA** | | **External** | | **Total** |
|  | **Robotics and Its Applications** | Elective | Y | - | - | - | | 3 | 4 | 25 | | 75 | | 100 |
| **Course Objective** | | | | | | | | | | | | |
| C1 | To understand the robotics fundamentals | | | | | | | | | | | |
| C2 | Understand the sensors and matrix methods | | | | | | | | | | | |
| C3 | Understand the Localization: Self-localizations and mapping | | | | | | | | | | | |
| C4 | To study about the concept of Path Planning, Vision system | | | | | | | | | | | |
| C5 | To learn about the concept of robot artificial intelligence | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | **No. of Hours** | | | **Course Objective** | |
| I | Introduction: Introduction, brief history, components of robotics, classification, workspace, work-envelop, motion of robotic arm, end-effectors and its types, service robot and its application, Artificial Intelligence in Robotics. | | | | | | | 12 | | | CO1 | |
| II | Actuators and sensors :Types of actuators, stepper-DC-servo-and brushless motors- model of a DC servo motor-types of transmissions-purpose of sensor-internal and external sensor-common sensors-encoders tachometers-strain gauge based force torque sensor-proximity and distance measuring sensors  Kinematics of robots: Representation of joints and frames, frames transformation, homogeneous matrix, D-H matrix, Forward and inverse kinematics: two link planar (RR) and spherical robot (RRP). Mobile robot Kinematics: Differential wheel mobile robot | | | | | | | 12 | | | CO2 | |
| III | Localization: Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems. | | | | | | | 12 | | | CO3 | |
| IV | Path Planning: Introduction, path planning-overview-road map path planning-cell decomposition path planning potential field path planning-obstacle avoidance-case studies  Vision system: Robotic vision systems-image representation-object recognition-and categorization-depth measurement- image data compression-visual inspection-software considerations | | | | | | | 12 | | | CO4 | |
| V | Application: Ariel robots-collision avoidance robots for agriculture-mining-exploration-underwater-civilian- and military applications-nuclear applications-space Applications-Industrial robots-artificial intelligence in robots-application of robots in material handling-continuous arc welding-spot welding-spray painting-assembly operation-cleaning-etc. | | | | | | | 12 | | | CO5 | |
|  | **Total** | | | | | | | **60** | | |  | |
| **Course Outcomes** | | | | | | | **Programme Outcomes** | | | | | |
| CO | On completion of this course, students will | | | | | |  | | | | | |
| 1 | Describe the different physical forms of robot architectures. | | | | | | PO1 | | | | | |
| 2 | Kinematically model simple manipulator and mobile robots. | | | | | | PO1, PO2 | | | | | |
| 3 | Mathematically describe a kinematic robot system | | | | | | PO4, PO6 | | | | | |
| 4 | Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty. | | | | | | PO4, PO5, PO6 | | | | | |
| 5 | Program robotics algorithms related to kinematics, control, optimization, and uncertainty. | | | | | | PO3, PO8 | | | | | |
| **Text Book** | | | | | | | | | | | | |
| 1 | RicharedD.Klafter. Thomas Achmielewski and MickaelNegin, Robotic Engineering and Integrated Approach, Prentice Hall India-Newdelhi-2001 | | | | | | | | | | | |
| 2 | SaeedB.Nikku, Introduction to robotics, analysis, control and applications, Wiley-India, 2 nd edition 2011 | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | |
| 1. | Industrial robotic technology-programming and application by M.P.Groover et.al, McGrawhill2008 | | | | | | | | | | | |
| 2. | Robotics technology and flexible automation by S.R.Deb, THH-2009 | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | |
| 1. | <https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm> | | | | | | | | | | | |
| 2. | <https://www.geeksforgeeks.org/robotics-introduction/> | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | S |  |  |  |  |  |  |  |
| **CO 2** | M | S |  |  |  |  |  |  |
| **CO 3** |  |  |  | S |  | S |  |  |
| **CO 4** |  |  |  | S | S | M |  |  |
| **CO 5** |  |  | S |  |  |  |  | S |

**S-Strong M-Medium L-Low**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | | **Credits** | **Inst. Hours** | | **Marks** | | |
| **CIA** | **External** | **Total** | |
|  | **Computational Intelligence** | Elective | 4 | - | - | - | | 3 | 4 | | 25 | 75 | 100 | |
| **Course Objective** | | | | | | | | | | | | | |
| C1 | To identify and understand the basics of AI and its search. | | | | | | | | | | | | |
| C2 | To study about the Fuzzy logic systems. | | | | | | | | | | | | |
| C3 | Understand and apply the concepts of Neural Network and its functions. | | | | | | | | | | | | |
| C4 | Understand the concepts of Artifical Neural Network | | | | | | | | | | | | |
| C5 | To study about the Genetic Algorithm. | | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | | | **No. of Hours** | **Course Objective** | | |
| I | **Introduction to AI**: Problem formulation – AI Applications – Problems – State Space and Search – Production Systems – Breadth First and Depth First – Travelling Salesman Problem – Heuristic search techniques: Generate and Test – Types of Hill Climbing. | | | | | | | | | 12 | C1 | | |
| II | **Fuzzy Logic Systems:**  Notion of fuzziness – Operations on fuzzy sets – T-norms and other aggregation operators – Basics of Approximate Reasoning – Compositional Rule of Inference – Fuzzy Rule Based Systems – Schemes of Fuzzification – Inferencing – Defuzzification – Fuzzy Clustering – fuzzy rule-based classifier. | | | | | | | | | 12 | C2 | | |
| III | **Neural Networks:** What is Neural Network, Learning rules and various activation functions, Single layer Perceptions, Back Propagation networks, Architecture of Backpropagation (BP) Networks, Back propagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications | | | | | | | | | 12 | C3 | | |
| IV | **Artificial Neural Networks:** Fundamental Concepts – Basic Models of Artificial Neural Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron – Linear Separability – Hebb Network. | | | | | | | | | 12 | C4 | | |
| V | **Genetic Algorithm:** Introduction – Biological Background – Genetic Algorithm Vs Traditional Algorithm – Basic Terminologies in Genetic Algorithm – Simple GA – General Genetic Algorithm – Operators in Genetic Algorithm | | | | | | | | | 12 | C5 | | |
|  | **Total** | | | | | | | | | **60** |  | | |
| **Course Outcomes** | | | | | | | **Programme Outcomes** | | | | | | |
| CO | On completion of this course, students will | | | | | |  | | | | | | |
| 1 | Describe the fundamentals of artificial intelligence concepts and searching techniques. | | | | | | PO1 | | | | | | |
| 2 | Develop the fuzzy logic sets and membership function and defuzzification techniques. | | | | | | PO1, PO2 | | | | | | |
| 3 | Understand the concepts of Neural Network and analyze and apply the learning techniques | | | | | | PO4, PO6 | | | | | | |
| 4 | Understand the artificial neural networks and its applications. | | | | | | PO4, PO5, PO6 | | | | | | |
| 5 | Understand the concept of Genetic Algorithm and Analyze the optimization problems using GAs. | | | | | | PO3, PO8 | | | | | | |
| **Text Book** | | | | | | | | | | | | | |
| 1 | S.N. Sivanandam and S.N. Deepa, “Principles of Soft Computing”, 2nd Edition, Wiley India Pvt. Ltd. | | | | | | | | | | | | |
| 2 | Stuart Russell and Peter Norvig, “Artificial Intelligence - A Modern Approach”, 2nd Edition, Pearson Education in Asia. | | | | | | | | | | | | |
| 3 | S. Rajasekaran, G. A. Vijayalakshmi, “Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications”, PHI. | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | |
| 1. | F. Martin, Mc neill, and Ellen Thro, “Fuzzy Logic: A Practical approach”, AP Professional, 2000. Chin Teng Lin, C. S. George Lee,” Neuro-Fuzzy Systems”, PHI | | | | | | | | | | | | |
| 2. | Chin Teng Lin, C. S. George Lee,” Neuro-Fuzzy Systems”, PHI. | | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | | |
| 1. | <https://www.javatpoint.com/artificial-intelligence-tutorial> | | | | | | | | | | | | |
| 2. | <https://www.w3schools.com/ai/> | | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

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|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | S |  |  |  |  |  |  |  |
| **CO 2** | M | S |  |  |  |  |  |  |
| **CO 3** |  |  |  | S |  | S |  |  |
| **CO 4** |  |  |  | S | S | M |  |  |
| **CO 5** |  |  | S |  |  |  |  | S |

**S-Strong M-Medium L-Low**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | | **External** | **Total** |
|  | **Grid Computing** | Elective | - | Y | - | - | 3 | 4 | 25 | | 75 | 100 |
| **Course Objective** | | | | | | | | | | | | |
| C1 | To learn the basic construction and application of Grid computing. | | | | | | | | | | | |
| C2 | To learn grid computing organization and their Role. | | | | | | | | | | | |
| C3 | To learn Grid Computing Anotomy. | | | | | | | | | | | |
| C4 | To learn Grid Computing road map. | | | | | | | | | | | |
| C5 | To learn various type of Grid Architecture. | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | | | | **No. of Hours** | |
| I | Introduction: Early Grid Activity, Current Grid Activity, Overview of Grid Business areas, Grid Applications, Grid Infrastructures. | | | | | | | | | | 12 | |
| II | Grid Computing organization and their Roles: Organizations Developing Grid Standards, and Best Practice Guidelines, Global Grid Forum (GCF), #Organization Developing Grid Computing Toolkits and Framework#, Organization and building and using grid based solutions to solve computing, commercial organization building and Grid Based solutions. | | | | | | | | | | 12 | |
| III | Grid Computing Anatomy: The Grid Problem, The conceptual of virtual organizations, # Grid Architecture # and relationship to other distributed technology. | | | | | | | | | | 12 | |
| IV | The Grid Computing Road Map: Autonomic computing, Business on demand and infrastructure virtualization, Service-Oriented Architecture and Grid, #Semantic Grids#. | | | | | | | | | | 12 | |
| V | Merging the Grid services Architecture with the Web Services Architecture: Service-Oriented Architecture, Web Service Architecture, #XML messages and Enveloping#, Service message description Mechanisms, Relationship between Web Services and Grid Services, Web services Interoperability and the role of the WS-I Organization. | | | | | | | | | | 12 | |
|  | **Total** | | | | | | | | | | **60** | |
| **Course Outcomes** | | | | | | | | | | **Programme Outcome** | | |
| CO | On completion of this course, students will | | | | | | | | |  | | |
| 1 | To understand the basic elements and concepts of Grid computing. | | | | | | | | | PO1 | | |
| 2 | To understand the Grid computing toolkits and Framework. | | | | | | | | | PO1, PO2 | | |
| 3 | To understand the concepts of Anotomy of Grid Computing. | | | | | | | | | PO4, PO6 | | |
| 4 | To understand the concept of service oriented architecture. | | | | | | | | | PO4, PO5, PO6 | | |
| 5 | To Gain knowledge on grid and web service architecture. | | | | | | | | | PO3, PO8 | | |
| **Text Book** | | | | | | | | | | | | |
| 1 | Joshy Joseph and Craig Fellenstein, Grid computing, Pearson / IBM Press, PTR, 2004. | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | |
| 1. | 1. Ahmer Abbas and Graig computing, A Practical Guide to technology and applications, Charles River Media, 2003. | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | |
| 1. | https://en.wikipedia.org/wiki/Grid\_computing | | | | | | | | | | | |
| 2. | https://link.springer.com/chapter/10.1007/978-1-84882-409-6\_4 | | | | | | | | | | | |
| 3. | https://www.redbooks.ibm.com/redbooks/pdfs/sg246778.pdf | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | **S** |  |  |  |  |  |  |  |
| **CO 2** | **S** | **S** |  |  |  |  |  |  |
| **CO 3** |  |  |  | **S** |  | **S** |  |  |
| **CO 4** |  |  |  | **S** | **S** | **S** |  |  |
| **CO 5** |  |  | **S** |  |  |  |  | **S** |

**S-Strong M-Medium L-Low**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Trends in Computing** | Elective | - | Y | - | - | 3 | 4 | 25 | 75 | 100 |
| **Course Objective** | | | | | | | | | | | |
| C1 | Learning current trends in various computer science and information technology fields. | | | | | | | | | | |
| C2 | Learning various fields of Cloud computing, Green computing ,the Edge and Fog computing technology. | | | | | | | | | | |
| C3 | To learn about Architecture and Application design of Cloud, Edge & fog computing. | | | | | | | | | | |
| C4 | To know computing and to improve security services of computing technologies. | | | | | | | | | | |
| C5 | To learn the various Case Studies in Cloud, Edge & fog Computing. | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | | | **No. of Hours** | |
| I | **Era of Cloud Computing**: Introduction – Components of Cloud Computing – Cloud Types: Private, Public and Hybrid clouds – Limitations of the Cloud - **Virtualization**: Structure and Mechanisms. | | | | | | | | | 12 | |
| II | **Cloud computing Services**: Software as a Service(SaaS) – Platform as a Service(PaaS)- Infrastructure as a Service(IaaS)**-**Database as a Service(DBaaS)- Recent Trends in cloud computing and Standards-**Data Security in Cloud** – Risks and Challenges with Cloud Data- Security as a Service. | | | | | | | | | 12 | |
| III | **Edge Computing:** Edge Computing and Its Essentials: Introduction- Edge Computing Architecture- Advantages and Limitations of Edge Computing Systems- Edge Computing Interfaces and Devices - Edge Analytics: Edge Data Analytics – Potential of Edge Analytics – Architecture of Edge Analytics – Case study | | | | | | | | | 12 | |
| IV | **Edge Data storage Security:** Edge-Based Attack Detection and Prevention-Edge Computing Use Cases and Case Studies: Edge Computing High- Potential Use Cases.  **Introduction to green computing**–Calculating carbon footprint-**Choosing Green PC path:** A green make over – Buying green computer- Choosing Earth Friendly peripherals | | | | | | | | | 12 | |
| V | Fog Computing: Introduction to Fog computing – Architecture - Characteristics - Fog Computing Services – Fog Resource Estimation and Its Challenges-Fog computing on 5G networks – Fog computing Use cases and Case studies. | | | | | | | | | 12 | |
|  | **Total** | | | | | | | | | **60** | |
| **Course Outcomes** | | | | | | | | | | | |
| CO | On completion of this course, students will | | | | | | | | | | |
| 1 | Outline the concepts, applications, benefits and limitations of various computing paradigms. | | | | | | | | | | |
| 2 | Classify the computing technologies based on its architecture and infrastructure and identify its strategies. | | | | | | | | | | |
| 3 | Examine various cloud services, Security threat exposure within a cloud computing infrastructure. | | | | | | | | | | |
| 4 | Asses the problems and solutions involved in various stages of different computing environments. | | | | | | | | | | |
| 5 | Discuss the importance of cloud, edge and Fog technology and implement innovative ideas and practices for regulating green IT. | | | | | | | | | | |
| **Text Book** | | | | | | | | | | | |
| 1 | Kailas Jayaswal,Jagannath Kallakurchi,Donald J.Houde,Dr.Devan Shah “ Cloud Computing –Black Book” Edition :2020 (UNIT I & II : CHAPTER 1,2,3,9,11) | | | | | | | | | | |
| 2 | K. Anitha Kumari G. Sudha Sadasivam D. Dharani M. Niranjanamurthy, “EDGE COMPUTING Fundamentals, Advances and Applications”, First Edition 2022, CRC Press. ( UNIT III & IV : CHAPTER 1, 2 , 3, 4,5,6 ) | | | | | | | | | | |
| 3 | Woody Leonhard and Katherine Murray (2009) ,Green Home Computing for Dummies,Willey Publishing Inc. (UNIT IV : CHAPTER 2 ,5,6,7) | | | | | | | | | | |
| 4 | Evangelos Markakis, George Mastorakis, Constandinos X.Mavromoutakis and Evangelos pallis “Cloud and Fog computing in 5G mobile Networks” ,First edition 2017. ( UNIT V: CHAPTER 2 ) | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
| 1. | RajKumar Buyya, ChristianVecchiola, S.ThamaraiSelvi, (2013), Mastering Cloud Computing, McGraw Hill Education. | | | | | | | | | | |
| 2. | Michael Miller, (2009), Cloud Computing, Pearson Education. | | | | | | | | | | |
| 3. | Shijun Liu Bedir Tekinerdogan Mikio Aoyama Liang-Jie Zhang” Edge Computing – EDGE “ 2018. | | | | | | | | | | |
| 4. | FlavioBonomi, Rodolfo Milito, Jiang Zhu, SateeshAddepalli, ―Fog Computing and Its Role in the Internet of Thingsǁ, MCC’12, August 17, 2012, Helsinki, Finland. Copyright 2012. | | | | | | | | | | |
| 5 | Amir M. Rahmani · Pasi Liljeberg Jürgo-Sören Preden “Fog Computing in the Internet of Things”Springer,2018. ( UNIT V: PART/CHAPTER (1.4,2.5) | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | |
| 1. | https://static.googleusercontent.com/media[/www.goo](http://www.google.com/en/green/pdfs/google-green-)g[le.com/en//green/pdfs/google-green-](http://www.google.com/en/green/pdfs/google-green-) computing.pdf ( Case Study) | | | | | | | | | | |
| 2. | <http://whatiscloud.com/basic_concepts_and_terminology/cloud> | | | | | | | | | | |
| 3. | <http://www.computerweekly.com/guides/Using-green-computing-for-improving-energy-> efficiency | | | | | | | | | | |

**Mapping with Programme Outcomes:**

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|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | **S** |  |  |  |  |  |  |  |
| **CO 2** | **S** | **S** |  |  |  |  |  |  |
| **CO 3** |  |  |  | **S** |  | **S** |  |  |
| **CO 4** |  |  |  | **S** | **S** | **S** |  |  |
| **CO 5** |  |  | **S** |  |  |  |  | **S** |

**S-Strong M-Medium L-Low**

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| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Artificial Neural Networks** | Core | - | Y | - | - | | 3 | 4 | 25 | 75 | 100 |
| **Course Objective** | | | | | | | | | | | | |
| C1 | **Understand the basics of artificial neural networks, learning process, single layer and multi-layer perceptron networks.** | | | | | | | | | | | |
| C2 | Understand the Error Correction and various learning algorithms and tasks. | | | | | | | | | | | |
| C3 | Identify the various Single Layer Perception Learning Algorithm. | | | | | | | | | | | |
| C4 | Identify the various Multi-Layer Perception Network. | | | | | | | | | | | |
| C5 | Analyze the Deep Learning of various Neural network and its Applications. | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | | | | **No. of Hours** | |
| I | Artificial Neural Model- Activation functions- Feed forward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem - Multilayer Networks. Learning Algorithms- Error correction - Gradient Descent Rules, Perception Learning Algorithm, Perception Convergence Theorem. | | | | | | | | | | 12 | |
| II | Introduction, Error correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, credit assignment problem, Learning with and without teacher, learning tasks, Memory and Adaptation. | | | | | | | | | | 15 | |
| III | .Single layer Perception: Introduction, Pattern Recognition, Linear classifier, Simple perception, Perception learning algorithm, Modified Perception learning algorithm, Adaptive linear combiner, Continuous perception, Learning in continuous perception. Limitation of Perception. | | | | | | | | | | 12 | |
| IV | Multi-Layer Perception Networks: Introduction, MLP with 2 hidden layers, Simple layer of a MLP, Delta learning rule of the output layer, Multilayer feed forward neural network with continuous perceptions, Generalized delta learning rule, Back propagation algorithm | | | | | | | | | | 12 | |
| V | Deep learning- Introduction- Neuro architectures building blocks for the DL techniques, Deep Learning and Neocognitron, Deep Convolutional Neural Networks, Recurrent Neural Networks (RNN), feature extraction, Deep Belief Networks, Restricted Boltzman Machines, Training of DNN and Applications | | | | | | | | | | 12 | |
|  | **Total** | | | | | | | | | | **60** | |
| **Course Outcomes** | | | | | | | **Programme Outcome** | | | | | |
| CO | On completion of this course, students will | | | | | |  | | | | | |
| 1 | **Students will learn the basics of artificial neural networks with single layer and multi-layer perception networks.** | | | | | | PO1 | | | | | |
| 2 | Learn about the Error Correction and various learning algorithms and tasks. | | | | | | PO1, PO2 | | | | | |
| 3 | Learn the various Perception Learning Algorithm. | | | | | | PO4, PO6 | | | | | |
| 4 | Learn about the various Multi-Layer Perception Network. | | | | | | PO4, PO5, PO6 | | | | | |
| 5 | Understand the Deep Learning of various Neural network and its Applications. | | | | | | PO3, PO8 | | | | | |
| **Text Book** | | | | | | | | | | | | |
| 1 | Neural Networks A Classroom Approach- Satish Kumar, McGraw Hill- Second Edition. | | | | | | | | | | | |
| 2. | “Neural Network- A Comprehensive Foundation”- Simon Haykins, Pearson Prentice Hall, 2nd Edition, 1999. | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | |
| 1. | Artificial Neural Networks-B. Yegnanarayana, PHI, New Delhi 1998. | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | |
| 1. | https://www.w3schools.com/ai/ai\_neural\_networks.asp | | | | | | | | | | | |
| 2. | https://en.wikipedia.org/wiki/Artificial\_neural\_network | | | | | | | | | | | |
| 3. | https://link.springer.com/chapter/10.1007/978-3-642-21004-4\_12 | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

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|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | **S** |  |  |  |  |  |  |  |
| **CO 2** | **S** | **S** |  |  |  |  |  |  |
| **CO 3** |  |  |  | **S** |  | **S** |  |  |
| **CO 4** |  |  |  | **S** | **S** | **S** |  |  |
| **CO 5** |  |  | **S** |  |  |  |  | **S** |

**S-Strong M-Medium L-Low**

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| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** | |
|  | **Agile Project Management** | Elective | - | Y | - | - | 3 | 4 | 25 | 75 | 100 | |
| **Course Objective** | | | | | | | | | | | |
| C1 | Learning of software design, software technologies and APIs. | | | | | | | | | | |
| C2 | Detailed demonstration about Agile development and testing techniques. | | | | | | | | | | |
| C3 | Learning about Agile Planning and Execution. | | | | | | | | | | |
| C4 | Learning of Agile Management Design and Quality Check. | | | | | | | | | | |
| C5 | Detailed examination of Agile development and testing techniques. | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | | | **No. of Hours** | |
| I | **Introduction:Modernizing Project Management:** Project Management Needed a Makeover – Introducing Agile Project Management.  **Applying the Agile Manifesto and Principles:** Understanding the Agile manifesto – Outlining the four values of the Agile manifesto – Defining the 15 Agile Principles – Adding the Platinum Principles – Changes as a result of Agile Values – The Agile litmus test.  **Why Being Agile Works Better:** Evaluating Agile benefits – How Agile approaches beat historical approaches – Why people like being Agile. | | | | | | | | | 12 | |
| II | **Being Agile**  **Agile Approaches:** Diving under the umbrella of Agile approaches – Reviewing the Big Three: Lean, Scrum, Extreme Programming - Summary  **Agile Environments in Action:** Creating the physical environment – Low-tech communicating – High-tech communicating – Choosing tools.  **Agile Behaviours in Action:** Establishing Agile roles – Establishing new values – Changing team philosophy. | | | | | | | | | 12 | |
| III | **Agile Planning and Execution**  **Defining the Product Vision and Roadmap:** Agile planning – Defining the product vision – Creating a product roadmap – Completing the product backlog.  **Planning Releases and Sprints:** Refining requirements and estimates – Release planning – Sprint planning.  **Working Throughout the Day:** Planning your day – Tracking progress – Agile roles in the sprint – Creating shippable functionality – The end of the day.  **Showcasing Work, Inspecting and Adapting:** The sprint review – The sprint retrospective.  **Preparing for Release:** Preparing the product for deployment (the release sprint) – Preparing the operational support – Preparing the organization for product deployment - Preparing the marketplace for product deployment | | | | | | | | | 12 | |
| IV | **Agile Management**  **Managing Scope and Procurement:** What’s different about Agile scope management – Managing Agile scope – What’s different about Agile procurement – Managing Agile procurement.  **Managing Time and Cost:** What’s different about Agile time management – Managing Agile schedules – What’s different about Agile cost management – Managing Agile budgets.  **Managing Team Dynamics and Communication:** What’s different about Agile team dynamics – Managing Agile team dynamics – What’s different about Agile communication – Managing Agile communication.  **Managing Quality and Risk:** What’sdifferent about Agile quality – Managing Agile quality – What’s different about Agile risk management – Managing Agile risk. | | | | | | | | | 12 | |
| V | **Implementing Agile**  **Building a Foundation:** Organizational and individual commitment – Choosing the right pilot team members – Creating and environment that enables Agility – Support Agility initially and over time.  **Being a Change Agent:** Becoming Agile requires change – why change doesn’t happen on its own – Platinum Edge’s Change Roadmap – Avoiding pitfalls – Signs your changes are slipping. **Benefits, Factors for Success and Metrics:** Ten key benefits of Agile project anagement – Ten key factors for project success – Ten metrics for Agile Organizations. | | | | | | | | | 12 | |
|  | **Total** | | | | | | | | | **60** | |
| **Course Outcomes** | | | | | | | | | | | |
| CO | On completion of this course, students will | | | | | | | | | | |
| 1 | Understanding of software design, software technologies and APIs using Agile Management. | | | | | | | | | | |
| 2 | Understanding of Agile development and testing techniques. | | | | | | | | | | |
| 3 | Understanding about Agile Planning and Execution using Sprint. | | | | | | | | | | |
| 4 | Understanding of Agile Management Design, scope , Procurement, managing Time and Cost and Quality Check. | | | | | | | | | | |
| 5 | Analysing of Agile development and testing techniques. | | | | | | | | | | |
| **Text Book** | | | | | | | | | | | |
| 1 | Mark C. Layton, Steven J. Ostermiller, Agile Project Management for Dummies, 2nd Edition, Wiley India Pvt. Ltd., 2018. | | | | | | | | | | |
|  | Jeff Sutherland, Scrum – The Art of Doing Twice the Work in Half the Time, Penguin, 2014. | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
| 1. | Mark C. Layton, David Morrow, *Scrum for Dummies*, 2nd Edition, Wiley India Pvt. Ltd., 2018. | | | | | | | | | | |
| 2. | Mike Cohn, Succeeding with Agile – Software Development using Scrum, Addison-Wesley Signature Series, 2010. | | | | | | | | | | |
| 3. | Alex Moore, Agile Project Management, 2020. | | | | | | | | | | |
| 4. | Alex Moore, *Scrum*, 2020. | | | | | | | | | | |
| 5. | Andrew Stellman and Jennifer Greene, *Learning Agile: Understanding Scrum, XP, Lean, and Kanban*, Shroff/O'Reilly, First Edition, 2014. | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | |
| 1. | [www.agilealliance.org/resources](http://www.agilealliance.org/resources) | | | | | | | | | | |

**Mapping with Programme Outcomes:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | **S** |  |  |  |  |  |  |  |
| **CO 2** | **S** | **S** |  |  |  |  |  |  |
| **CO 3** |  |  |  | **S** |  | **S** |  |  |
| **CO 4** |  |  |  | **S** | **S** | **S** |  |  |
| **CO 5** |  |  | **S** |  |  |  |  | **S** |

**S-Strong M-Medium L-Low**

**Annexure II**

**Skill Enhancement Course SEC1** – **SEC8**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
| **SEC1** | **OFFICE AUTOMATION** | Specific Elective |  | Y | - | - | | 2 | 2 | 25 | 75 | 100 |
| **Course Objective** | | | | | | | | | | | | |
| C1 | Understand the basics of computer systems and its components. | | | | | | | | | | | |
| C2 | Understand and apply the basic concepts of a word processing package. | | | | | | | | | | | |
| C3 | Understand and apply the basic concepts of electronic spreadsheet software. | | | | | | | | | | | |
| C4 | Understand and apply the basic concepts of database management system. | | | | | | | | | | | |
| C5 | Understand and create a presentation using PowerPoint tool. | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | | | | **No. of Hours** | |
| I | **Introductory concepts:** Memory unit– CPU-Input Devices: Key board, Mouse and Scanner. Output devices: Monitor, Printer. Introduction to Operating systems & its features: DOS– UNIX–Windows. Introduction to Programming Languages. | | | | | | | | | | 6 | |
| II | **Word Processing:** Open, Save and close word document; Editing text – tools, formatting, bullets; Spell Checker - Document formatting – Paragraph alignment, indentation, headers and footers, numbering; printing–Preview, options, merge. | | | | | | | | | | 6 | |
| III | **Spreadsheets :** Excel–opening, entering text and data, formatting, navigating; Formulas–entering, handling and copying; Charts–creating, formatting and printing, analysis tables, preparation of financial statements, introduction to data analytics. | | | | | | | | | | 6 | |
| IV | **Database Concepts:** The concept of data base management system; Data field, records, and files, Sorting and indexing data; Searching records. Designing queries, and reports; Linking of datafiles; Understanding Programming environment in DBMS; Developing menu drive applications in query language (MS–Access). | | | | | | | | | | 6 | |
| V | **Power point:** Introduction to Power point - Features – Understanding slide typecasting & viewing slides – creating slide shows. Applying special object – including objects & pictures – Slide transition–Animation effects, audio inclusion, timers. | | | | | | | | | | 6 | |
|  | **Total** | | | | | | | | | | **30** | |
| **Course Outcomes** | | | | | | | **Programme Outcomes** | | | | | |
| CO | On completion of this course, students will | | | | | |  | | | | | |
| 1 | Possess the knowledge on the basics of computers and its components | | | | | | PO1,PO2,PO3,PO6,PO8 | | | | | |
| 2 | Gain knowledge on Creating Documents, spreadsheet and presentation. | | | | | | PO1,PO2,PO3,PO6 | | | | | |
| 3 | Learn the concepts of Database and implement the Query in Database. | | | | | | PO3,PO5,PO7 | | | | | |
| 4 | Demonstrate the understanding of different automation tools. | | | | | | PO3,PO4,PO5,PO7 | | | | | |
| 5 | Utilize the automation tools for documentation, calculation and presentation purpose. | | | | | | PO4,PO6,PO7,PO8 | | | | | |
| **Text Book** | | | | | | | | | | | | |
| 1 | Peter Norton,“Introduction to Computers”–Tata Mc Graw-Hill. | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | |
| 1. | Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, “Microsoft 2003”, Tata McGrawHill. | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | |
| 1. | <https://www.udemy.com/course/office-automation-certificate-course/> | | | | | | | | | | | |
| 2. | <https://www.javatpoint.com/automation-tools> | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

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|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | M | S | M |  |  | M |  | L |
| **CO 2** | S | M | S |  |  | M |  |  |
| **CO 3** |  | S | S |  | M |  | L |  |
| **CO 4** |  |  | S | L | M |  | M |  |
| **CO 5** |  |  |  | M |  | S | M | S |

**S-Strong M-Medium L-Low**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | | | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | | **Marks** | | | |
| **CIA** | **External** | | **Total** |
| **SEC2** | | | | Basics of Internet | Specific Elective | 2 | - | - |  | 2 | | 25 | 75 | | 100 |
| **Learning Objectives** | | | | | | | | | | | | | | | |
| LO1 | | | Knowledge of Internet medium | | | | | | | | | | | | |
| LO2 | | | Internet as a mass medium | | | | | | | | | | | | |
| LO3 | | | Features of Internet Technology, | | | | | | | | | | | | |
| LO4 | | | Internet as source of infotainment | | | | | | | | | | | | |
| LO5 | | | Study of internet audiences and about cyber crime | | | | | | | | | | | | |
| **UNIT** | | | **Contents** | | | | | | | | | | | **No. Of. Hours** | |
| I | | | The emergence of internet as a mass medium – the world of ‘world wide web’. | | | | | | | | | | | **6** | |
| II | | | Features of internet as a technology. | | | | | | | | | | | **6** | |
| III | | | Internet as a source of infotainment – classification based on content and style. | | | | | | | | | | | **6** | |
| IV | | | Demographic and psychographic descriptions of internet ‘audiences’ – effect of internet on the values and life-styles. | | | | | | | | | | | **6** | |
| V | | | Present issues such as cyber crime and future possibilities. | | | | | | | | | | | **6** | |
| **TOTAL HOURS** | | | | | | | | | | | | | | **30** | |
|  | | | | | | | | | | |  | | | | |
| CO | | **Course Outcomes** | | | | | | | | |  | | | | |
| CO1 | | * Knows the basic concept in HTML   Concept of resources in HTML | | | | | | | | | | | | | |
| CO2 | | Knows Design concept.  Concept of Meta Data  Understand the concept of save the files. | | | | | | | | | | | | | |
| CO3 | | Understand the page formatting.  Concept of list | | | | | | | | | | | | | |
| CO4 | | Creating Links.  Know the concept of creating link to email address | | | | | | | | | | | | | |
| CO5 | | Concept of adding images  Understand the table creation. | | | | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | | | | | |
| 1 | “Mastering HTML5 and CSS3 Made Easy”, TeachUComp Inc., 2014. | | | | | | | | | | | | | | |
| 2 | Thomas Michaud, “Foundations of Web Design: Introduction to HTML & CSS” | | | | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | | | | |
| 1. | <https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf> | | | | | | | | | | | | | | |
| 2. | <https://www.w3schools.com/html/default.asp> | | | | | | | | | | | | | | |

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| **Subject Code** | | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | | **PROBLEM SOLVING TECHNIQUES** | Specific Elective | Y | - | - | - | | 2 | 2 | 25 | 75 | 100 |
| **Course Objective** | | | | | | | | | | | | | |
| C1 | Understand the systematic approach to problem solving. | | | | | | | | | | | | |
| C2 | Know the approach and algorithms to solve specific fundamental problems. | | | | | | | | | | | | |
| C3 | Understand the efficient approach to solve specific factoring-related problems. | | | | | | | | | | | | |
| C4 | Understand the efficient array-related techniques to solve specific problems. | | | | | | | | | | | | |
| C5 | Understand the efficient methods to solve specific problems related to text processing.  Understand how recursion works. | | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | | | | | **No. of Hours** | |
| I | **Introduction:** Notion of algorithms and programs – Requirements for solving problems by computer – The problem-solving aspect: Problem definition phase, Getting started on a problem, The use of specific examples, Similarities among problems, Working backwards from the solution – General problem-solving strategies - Problem solving using top-down design – Implementation of algorithms – The concept of Recursion. | | | | | | | | | | | 6 | |
| II | **Fundamental Algorithms**: Exchanging the values of two variables – Counting - Summation of a set of numbers - Factorial computation - Sine function computation - Fibonacci Series generation - Reversing the digits of an integer – Base Conversion. | | | | | | | | | | | 6 | |
| III | **Factoring Methods**: Finding the square root of a number – The smallest divisor of an integer – Greatest common divisor of two integers - Generating prime numbers – Computing the prime factors of an integer – Generation of pseudo-random numbers - Raising a number to a large power – Computing the *n*th Fibonacci number. | | | | | | | | | | | 6 | |
| IV | **Array Techniques**: Array order reversal – Array counting or histograming – Finding the maximum number in a set - Removal of duplicates from an ordered array - Partitioning an array – Finding the *k*th smallest element – Longest monotone subsequence. | | | | | | | | | | | 6 | |
| V | **Text Processing and Pattern Searching**: Text line length adjustment – Left and right justification of text – Keyword searching in text – Text line editing – Linear pattern search.  **Recursive algorithms**: Towers of Hanoi – Permutation generation. | | | | | | | | | | | 6 | |
|  | **Total** | | | | | | | | | | | **30** | |
| **Course Outcomes** | | | | | | | | **Programme Outcome** | | | | | |
| CO | | On completion of this course, students will | | | | | |  | | | | | |
| 1 | | Understand the logic of problem and analyses implementation of algorithm and TopDown approach and concept of Recursion | | | | | | PO1,PO6 | | | | | |
| 2 | | Able to understand the Sequence of Numbers and Series Fibonacci, Reversing ,Base Conversion. | | | | | | PO2 | | | | | |
| 3 | | Able to do Algebraic operations | | | | | | PO2,PO4 | | | | | |
| 4 | | Coverage of Arrays and its Logics | | | | | | PO6,PO8 | | | | | |
| 5 | | Text Processing and Pattern Searching Approach | | | | | | PO7 | | | | | |
| **Text Book** | | | | | | | | | | | | | |
| 1 | | R. G. Dromey, *How to Solve it by Computer*, Pearson India, 2007 | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | |
| 1. | | George Polya, Jeremy Kilpatrick, *The Stanford Mathematics Problem Book: With Hints and Solutions*, Dover Publications, 2009 (Kindle Edition 2013). | | | | | | | | | | | |
| 2. | | Greg W. Scragg, *Problem Solving with Computers*, Jones & Bartlett 1st edition, 1996. | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | | |
| 1. | | <https://www.studytonight.com/> | | | | | | | | | | | |
| 2. | | <https://www.w3schools.com/> | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | M |  |  |  |  | S |  |  |
| **CO 2** |  | M |  |  |  |  |  |  |
| **CO 3** |  | S |  | L |  |  |  |  |
| **CO 4** |  |  |  |  |  | S |  | M |
| **CO 5** |  |  |  |  |  |  | M |  |

**S-Strong M-Medium L-Low**

**Multimedia Lab**

|  |  |  |  |  |  |  |  |  |  |  |  |
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| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
| **SEC4** | | **0** | **0** | **2** | **III** | **1** | **2** | **25** | **75** | | **100** |
| **Learning Objectives** | | | | | | | | | | | |
| **LO1** | Understands the basics of multimedia | | | | | | | | | | |
| **LO2** | Acquire knowledge of image editing and animation techniques. | | | | | | | | | | |
| **LO3** | Apply multimedia concepts to real world projects | | | | | | | | | | |
| **Unit** | **Contents** | | | | | | | | | **No. of Hours** | |
| I | GIMP’s Tools- Taking Advantage of Paths - Working with Layers and masks - Using Channels **Exercises:**  1. Enlarge a Logo using path 2. Create an ink drawing using path 3. Replace Background of image using Channels | | | | | | | | | **6** | |
| II | Manipulating Images: Transforming Images - Using The Image Tools - Adjusting Colors - Working with Text - Painting in Gimp: Creating new brushes - Enhancing Photos - Exploring Filters and Effects.  Exercises:   1. Design Front Cover for a Book. 2. Create a customized logo 3. Use clone tool to remove text from an image 4. Remove Red eye using Filter. | | | | | | | | | **6** | |
| III | Using GIMP animation package - Managing the Frames of Image Sequence with GAP - Morphing - onion skinning - Creating a Storyboard. **Exercises:**  1. Morphing - Create smooth transitions from one image to another. 2. Create a Story board for your project | | | | | | | | | **6** | |
| IV | Flash: Introduction - Creating and Editing Objects - Color and Text. Animations: Frame- by- frame animation-Motion Tweening- Motion Guides   1. Creating Frame-by-frame Animation 2. Create a Motion Tween for Graphic and Text Object 3. Create a Motion guide Layer | | | | | | | | | **6** | |
| V | Shape Tweening - Masking - Interactivity: Adding Script to Buttons - Testing and Publishing. **Exercises:**  1. Create a Shape Tween for Graphic Object 2. Create a Mask Layer 3. Adding buttons with Action Script | | | | | | | | | **6** | |
| TOTAL | | | | | | | | | | **30** | |
| CO | Course Outcomes | | | | | | | | | | |
| CO1 | Demonstrate understanding and use of multimedia fundamentals | | | | | | | | | | |
| CO2 | Implement appropriate techniques required for editing images and designing animated system | | | | | | | | | | |
| CO3 | Solve various design and implementation issues materialize on the development  of multimedia systems | | | | | | | | | | |
| CO4 | Assess different Photo Editing, Video Editing and animation tools and select the  appropriate tool based on the requirements | | | | | | | | | | |
| CO5 | Design and develop Multimedia Projects | | | | | | | | | | |
| **Textbooks** | | | | | | | | | | | |
|  | 1. Jason Van Gumster& Robert Shimonski (2010), “GIMP Bible”, Wiley, 2nd edition. 2. Chris Gover, 2010, “Flash CS5: The missing Manual”, 1st Edition, O‟ Reilly India. | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
| 1 | Juan Manuel Ferreyra (2011), “GIMP 2.6 Cookbook”, PACK publishing Ltd. | | | | | | | | | | |
| 2 | Robert Reinhard (2003), “Macromedia Flash MX Bible”, Wiley Dreamtech India Pvt Ltd. | | | | | | | | | | |
| **NOTE: Latest Edition of Textbooks May be Used** | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | |
| 1. | htt[ps://www](http://www.youtube.com/watch?v=T8NIK3RdoIc).[youtube.com/watch?v=T8NIK3RdoIc](http://www.youtube.com/watch?v=T8NIK3RdoIc) (Unit IV: Gimp Video Editing) | | | | | | | | | | |
| 2. | htt[ps://www](http://www.youtube.com/watch?v=Jz9WrbELGYA).[youtube.com/watch?v=Jz9WrbELGYA](http://www.youtube.com/watch?v=Jz9WrbELGYA) | | | | | | | | | | |

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|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | M | S | M |  |  | M |  | L |
| **CO 2** | S | M | S |  |  | M |  |  |
| **CO 3** |  | S | S |  | M |  | L |  |
| **CO 4** |  |  | S | L | M |  | M |  |
| **CO 5** |  |  |  | M |  | S | M | S |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Marks** | | | | |
| **CIA** | | **External** | | **Total** |
|  | | | Fundamentals of Information Technology | Specific Elective | 2 | - | - | I | 2 | 25 | | 75 | | 100 |
| **Learning Objectives** | | | | | | | | | | | | | | |
| **LO1** | Understand basic concepts and terminology of information technology. | | | | | | | | | | | | | |
| **LO2** | Have a basic understanding of personal computers and their operation | | | | | | | | | | | | | |
| **LO3** | Be able to identify data storage and its usage | | | | | | | | | | | | | |
| **LO4** | Get great knowledge of software and its functionalities | | | | | | | | | | | | | |
| **LO5** | Understand about operating system and their uses | | | | | | | | | | | | | |
| **UNIT** | **Contents** | | | | | | | | | | | | **No. Of. Hours** | |
| I | **Introduction to Computers:**  Introduction, Definition, .Characteristics of computer, Evolution of Computer, Block Diagram Of a computer, Generations of Computer, Classification Of Computers, Applications of Computer, Capabilities and limitations of computer | | | | | | | | | | | | **6** | |
| II | **Basic Computer Organization:**  Role of I/O devices in a computer system. Input Units: Keyboard, Terminals and its types. Pointing Devices, Scanners and its types, Voice Recognition Systems, Vision Input System, Touch Screen, Output Units: Monitors and its types. Printers: Impact Printers and its types. Non Impact Printers and its types, Plotters, types of plotters, Sound cards, Speakers. | | | | | | | | | | | | **6** | |
| III | **Storage Fundamentals:**  Primary Vs Secondary Storage, Data storage & retrieval methods. Primary Storage: RAM ROM, PROM, EPROM, EEPROM. Secondary Storage: Magnetic Tapes, Magnetic Disks. Cartridge tape, hard disks, Floppy disks Optical Disks, Compact Disks, Zip Drive, Flash Drives | | | | | | | | | | | | **6** | |
| IV | **Software:**  Software and its needs, Types of S/W. System Software: Operating System, Utility Programs Programming Language: Machine Language, Assembly Language, High Level Language their advantages & disadvantages. Application S/W and its types: Word Processing, Spread Sheets Presentation, Graphics, DBMS s/w | | | | | | | | | | | | **6** | |
| V | **Operating System:**  Functions, Measuring System Performance, Assemblers, Compilers and Interpreters.Batch Processing, Multiprogramming, Multi Tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux. | | | | | | | | | | | | **6** | |
| **TOTAL HOURS** | | | | | | | | | | | | | **30** | |
| **Course Outcomes** | | | | | | | | | | | **Programme Outcomes** | | | |
| CO | | On completion of this course, students will | | | | | | | | |  | | | |
| CO1 | | * Learn the basics of computer, Construct the structure of the required things in computer, learn how to use it. | | | | | | | | | PO1, PO2, PO3, PO4, PO5, PO6 | | | |
| CO2 | | * Develop organizational structure using for the devices present currently under input or output unit. | | | | | | | | | PO1, PO2, PO3, PO4, PO5, PO6 | | | |
| CO3 | | Concept of storing data in computer using two header namely RAM and ROM with different types of ROM with advancement in storage basis. | | | | | | | | | PO1, PO2, PO3, PO4, PO5, PO6 | | | |
| CO4 | | * Work with different software, Write program in the software and applications of software. | | | | | | | | | PO1, PO2, PO3, PO4, PO5, PO6 | | | |
| CO5 | | Usage of Operating system in information technology which really acts as a interpreter between software and hardware. | | | | | | | | | PO1, PO2, PO3, PO4, PO5, PO6 | | | |
| **Textbooks** | | | | | | | | | | | | | | |
| 1 | | Anoop Mathew, S. Kavitha Murugeshan (2009), “ Fundamental of Information Technology”, Majestic Books. | | | | | | | | | | | | |
| 2 | | Alexis Leon, Mathews Leon,” Fundamental of Information Technology”, 2nd Edition. | | | | | | | | | | | | |
| 3 | | S. K Bansal, “Fundamental of Information Technology”. | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | |
| 1. | | Bhardwaj Sushil Puneet Kumar, “Fundamental of Information Technology” | | | | | | | | | | | | |
| 2. | | GG WILKINSON, “Fundamentals of Information Technology”, Wiley-Blackwell | | | | | | | | | | | | |
| 3. | | [A Ravichandran](https://www.bookganga.com/eBooks/Books?AID=5563813659127023211) , “Fundamentals of Information Technology”, Khanna Book Publishing | | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | | | |
| 1. | | https://testbook.com/learn/computer-fundamentals | | | | | | | | | | | | |
| 2. | | https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html | | | | | | | | | | | | |
| 3. | | https://www.javatpoint.com/computer-fundamentals-tutorial | | | | | | | | | | | | |
| 4. | | https://www.tutorialspoint.com/computer\_fundamentals/index.htm | | | | | | | | | | | | |
| 5. | | https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf | | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO 1** | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 2** | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 4** | 3 | 3 | 3 | 3 | 2 | 3 |
| **CO 5** | 3 | 3 | 2 | 3 | 3 | 2 |
| **Weightage of course contributed to each PSO** | 15 | 15 | 14 | 15 | 14 | 14 |

**S-Strong-3 M-Medium-2 L-Low-1**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | | | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | | **Marks** | | | |
| **CIA** | **External** | | **Total** |
|  | | | | Introduction to HTML | Specific Elective | 2 | - | - |  | 2 | | 25 | 75 | | 100 |
| **Learning Objectives** | | | | | | | | | | | | | | | |
| LO1 | | | Insert a graphic within a web page. | | | | | | | | | | | | |
| LO2 | | | Create a link within a web page. | | | | | | | | | | | | |
| LO3 | | | Create a table within a web page. | | | | | | | | | | | | |
| LO4 | | | Insert heading levels within a web page. | | | | | | | | | | | | |
| LO5 | | | Insert ordered and unordered lists within a web page. Create a web page. | | | | | | | | | | | | |
| **UNIT** | | | **Contents** | | | | | | | | | | | **No. Of. Hours** | |
| I | | | Introduction :Web Basics: What is Internet – Web browsers – What is Web page – HTML Basics: Understanding tags. | | | | | | | | | | | **6** | |
| II | | | Tags for Document structure( HTML, Head, Body Tag). Block level text elements: Headings paragraph(<p> tag) – Font style elements: (bold, italic, font, small, strong, strike, big tags) | | | | | | | | | | | **6** | |
| III | | | Lists: Types of lists: Ordered, Unordered – Nesting Lists – Other tags: Marquee, HR, BR- Using Images – Creating Hyperlinks. | | | | | | | | | | | **6** | |
| IV | | | Tables: Creating basic Table, Table elements, Caption – Table and cell alignment – Rowspan, Colspan – Cell padding. | | | | | | | | | | | **6** | |
| V | | | Frames: Frameset – Targeted Links – No frame – Forms : Input, Textarea, Select, Option. | | | | | | | | | | | **6** | |
| **TOTAL HOURS** | | | | | | | | | | | | | | **30** | |
| **Course Outcomes** | | | | | | | | | | | **Programme Outcomes** | | | | |
| CO | | On completion of this course, students will | | | | | | | | |  | | | | |
| CO1 | | * Knows the basic concept in HTML   Concept of resources in HTML | | | | | | | | | PO1, PO2, PO3, PO4, PO5, PO6 | | | | |
| CO2 | | Knows Design concept.  Concept of Meta Data  Understand the concept of save the files. | | | | | | | | | PO1, PO2, PO3, PO4, PO5, PO6 | | | | |
| CO3 | | Understand the page formatting.  Concept of list | | | | | | | | | PO1, PO2, PO3, PO4, PO5, PO6 | | | | |
| CO4 | | Creating Links.  Know the concept of creating link to email address | | | | | | | | | PO1, PO2, PO3, PO4, PO5, PO6 | | | | |
| CO5 | | Concept of adding images  Understand the table creation. | | | | | | | | | PO1, PO2, PO3, PO4, PO5, PO6 | | | | |
| **Textbooks** | | | | | | | | | | | | | | | |
| 1 | “Mastering HTML5 and CSS3 Made Easy”, TeachUComp Inc., 2014. | | | | | | | | | | | | | | |
| 2 | Thomas Michaud, “Foundations of Web Design: Introduction to HTML & CSS” | | | | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | | | | |
| 1. | <https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf> | | | | | | | | | | | | | | |
| 2. | <https://www.w3schools.com/html/default.asp> | | | | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO 1** | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 2** | 3 | 3 | 2 | 3 | 3 | 3 |
| **CO 3** | 2 | 3 | 3 | 3 | 3 | 3 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 5** | 3 | 3 | 3 | 2 | 3 | 3 |
| **Weightage of course contributed to each PSO** | 14 | 15 | 14 | 14 | 15 | 15 |

**S-Strong-3 M-Medium-2 L-Low-1**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | | **Credits** | **Inst. Hours** | | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **WEB DESIGNING** | Specific Elective | Y | - | - | - | | 2 | 2 | | 25 | 75 | 100 |
| **Course Objective** | | | | | | | | | | | | | |
| C1 | Understand the basics of HTML and its components | | | | | | | | | | | | |
| C2 | To study about the Graphics in HTML | | | | | | | | | | | | |
| C3 | Understand and apply the concepts of XML and DHTML | | | | | | | | | | | | |
| C4 | Understand the concept of JavaScript | | | | | | | | | | | | |
| C5 | To identify and understand the goals and objectives of the Ajax | | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | | | **No. of Hours** | | **Course Objective** | |
| I | HTML: HTML-Introduction-tag basics- page structure-adding comments working with texts, paragraphs and line break. Emphasizing test- heading and horizontal rules-list-font size, face and color-alignment links-tables-frames. | | | | | | | | | 6 | | C1 | |
| II | Forms & Images Using Html: Graphics: Introduction-How to work efficiently with images in web pages, image maps, GIF animation, adding multimedia, data collection with html forms textbox, password, list box, combo box, text area, tools for building web page front page. | | | | | | | | | 6 | | C2 | |
| III | XML & DHTML: Cascading style sheet (CSS)-what is CSS-Why we use CSS-adding CSS to your web pages-Grouping styles-extensible markup language (XML). | | | | | | | | | 6 | | C3 | |
| IV | Dynamic HTML: Document object model (DCOM)-Accessing HTML & CSS through DCOM Dynamic content styles & positioning-Event bubbling-data binding.  JavaScript: Client-side scripting, What is JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition, | | | | | | | | | 6 | | C4 | |
| V | Advance script, JavaScript and objects, JavaScript own objects, the DOM and web browser environments, forms and validations. | | | | | | | | | 6 | | C5 | |
|  | **Total** | | | | | | | | | **60** | |  | |
| **Course Outcomes** | | | | | | | **Programme Outcome** | | | | | | |
| CO | On completion of this course, students will | | | | | |  | | | | | | |
| 1 | Develop working knowledge of HTML | | | | | | PO1, PO3, PO6, PO8 | | | | | | |
| 2 | Ability to Develop and publish Web pages using Hypertext Markup Language (HTML). | | | | | | PO1,PO2,PO3,PO6 | | | | | | |
| 3 | Ability to optimize page styles and layout with Cascading Style Sheets (CSS). | | | | | | PO3, PO5 | | | | | | |
| 4 | Ability to develop a java script | | | | | | PO1, PO2, PO3, PO7 | | | | | | |
| 5 | An ability to develop web application using Ajax. | | | | | | P02, PO6, PO7 | | | | | | |
| **Text Book** | | | | | | | | | | | | | |
| 1 | Pankaj Sharma, “Web Technology”, SkKataria& Sons Bangalore 2011. | | | | | | | | | | | | |
| 2 | Mike Mcgrath, “Java Script”, Dream Tech Press 2006, 1st Edition. | | | | | | | | | | | | |
| 3 | Achyut S Godbole&AtulKahate, “Web Technologies”, 2002, 2nd Edition. | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | |
| 1. | Laura Lemay, RafeColburn , Jennifer Kyrnin, “Mastering HTML, CSS &Javascript Web Publishing”, 2016. | | | | | | | | | | | | |
| 2. | DT Editorial Services (Author), “HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)”, Paperback 2016, 2nd Edition. | | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | | |
| 1. | NPTEL & MOOC courses titled Web Design and Development. | | | | | | | | | | | | |
| 2. | <https://www.geeksforgeeks.org> | | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** |
| **CO 1** | S |  | M |  |  | L |
| **CO 2** | S | M | L |  |  | M |
| **CO 3** |  |  | S |  | M |  |
| **CO 4** | S | M | M |  |  |  |
| **CO 5** |  | M |  |  |  | L |

**S-Strong M-Medium L-Low**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | | | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | | **External** | **Total** |
|  | **SoftwareTesting** | Specific Elective | Y | - | - | - | | | 2 | 2 | 25 | | 75 | 100 |
| **Course Objective** | | | | | | | | | | | | | | |
| **C1** | To study fundamental concepts in software testing | | | | | | | | | | | | | |
| **C2** | To discuss various software testing issues and solutions in software unit test, integration and system testing. | | | | | | | | | | | | | |
| **C3** | To study the basic concept of Data flow testing and Domain testing. | | | | | | | | | | | | | |
| **C4** | To Acquire knowledge on path products and path expressions. | | | | | | | | | | | | | |
| **C5** | To learn about Logic based testing and decision tables | | | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | **No. of Hours** | | | | **Course Objective** | | |
| **I** | Introduction: Purpose–Productivity and Quality in Software–TestingVsDebugging–Model for Testing–Bugs–Types of Bugs – Testing and Design Style. | | | | | | | 6 | | | | C1 | | |
| **II** | Flow / Graphs and Path Testing – Achievable paths – Path instrumentation Application Transaction FlowTesting Techniques. | | | | | | | 6 | | | | C2 | | |
| **III** | Data Flow Testing Strategies - Domain Testing:Domains and Paths – Domains and Interface Testing. | | | | | | | 6 | | | | C3 | | |
| **IV** | Linguistic –Metrics – Structural Metric – Path Products and Path Expressions.SyntaxTesting–Formats–Test Cases | | | | | | | 6 | | | | C4 | | |
| **V** | Logic Based Testing–Decision Tables–Transition Testing–States, State Graph, StateTesting. | | | | | | | 6 | | | | C5 | | |
|  | **Total** | | | | | | | **30** | | | |  | | |
| **Course Outcomes** | | | | | | | **Program Outcomes** | | | | | | | |
| **CO** | On completion of this course, students will | | | | | |  | | | | | | | |
| **1** | Students learn to apply software testing knowledge and engineering methods | | | | | | PO1 | | | | | | | |
| **2** | Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation. | | | | | | PO1, PO2 | | | | | | | |
| **3** | Have an ability understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods. | | | | | | PO4, PO6 | | | | | | | |
| **4** | Have basic understanding and knowledge of contemporary issues in software testing, such as component-based software testing problems | | | | | | PO4, PO5, PO6 | | | | | | | |
| **5** | Have an ability to use software testing methods and modern software testing tools for their testing projects. | | | | | | PO3, PO8 | | | | | | | |
| **Text Book** | | | | | | | | | | | | | | |
| **1** | B.Beizer,“SoftwareTestingTechniques”,IIEdn.,DreamTechIndia,NewDelhi,2003. | | | | | | | | | | | | | |
| **2** | K.V.K.Prasad,“SoftwareTestingTools”,DreamTech.India,NewDelhi,2005 | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | |
| **1.** | I.Burnstein,2003,“PracticalSoftwareTesting”,SpringerInternationalEdn. | | | | | | | | | | | | | |
| **2.** | E. Kit, 1995, “Software Testing in the Real World: Improving the Process”, PearsonEducation,Delhi. | | | | | | | | | | | | | |
| **3.** | R. Rajani,andP.P.Oak,2004,“SoftwareTesting”,TataMcgrawHill,New Delhi. | | | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | | | |
| **1.** | <https://www.javatpoint.com/software-testing-tutorial> | | | | | | | | | | | | | |
| **2.** | <https://www.guru99.com/software-testing.html> | | | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** |
| **CO 1** | S |  |  |  |  |  |
| **CO 2** | M | S |  |  |  |  |
| **CO 3** |  |  |  | S |  | S |
| **CO 4** |  |  |  | S | S | M |
| **CO 5** |  |  | S |  |  |  |

**S-Strong M-Medium L-Low**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | | **Inst. Hours** | **Marks** | | | |
| **CIA** | | **External** | **Total** |
|  | Quantitative Aptitude | Specific Elective | Y | - | - | - | 2 | | 2 | 25 | | 75 | 100 |
| **Course Objective** | | | | | | | | | | | | | |
| C1 | To understand the basic concepts of numbers | | | | | | | | | | | | |
| C2 | Understand and apply the concept of percentage, profit & loss | | | | | | | | | | | | |
| C3 | To study the basic concepts of time and work, interests | | | | | | | | | | | | |
| C4 | To learn the concepts of permutation, probability, discounts | | | | | | | | | | | | |
| C5 | To study about the concepts of data representation, graphs | | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | **No. of Hours** | | | **Course Objective** | | |
| I | Numbers-HCF and LCM of numbers-Decimal fractions-Simplification-Squareroot and cuberoots - Average-problems on Numbers. | | | | | | | 6 | | | CO1 | | |
| II | Problems on Ages - Surds and Indices - percentage - profits and loss - ratio and proportion-partnership-Chainrule. | | | | | | | 6 | | | CO2 | | |
| III | Time and work - pipes and cisterns - Time and Distance - problems on trains -Boats and streams - simple interest - compound interest - Logarithms - Area-Volume and surfacearea -races and Gamesofskill. | | | | | | | 6 | | | CO3 | | |
| IV | Permutation and combination-probability-True Discount-Bankers Discount – Height and Distances-Oddmanout & Series. | | | | | | | 6 | | | CO4 | | |
| V | Calendar - Clocks - stocks and shares - Data representation - Tabulation - BarGraphs-Piecharts-Linegraphs. | | | | | | | 6 | | | CO5 | | |
|  | **Total** | | | | | | | **60** | | |  | | |
| **Course Outcomes** | | | | | | | | **Programme Outcome** | | | | | |
| CO | On completion of this course, students will | | | | | | |  | | | | | |
| 1 | understand the concepts, application and the problems of numbers | | | | | | | PO1 | | | | | |
| 2 | To have basic knowledge and understanding about percentage, profit & loss related processings | | | | | | | PO1, PO2 | | | | | |
| 3 | To understand the concepts of time and work | | | | | | | PO4, PO6 | | | | | |
| 4 | Speaks about the concepts of probability, discount | | | | | | | PO4, PO5, PO6 | | | | | |
| 5 | Understanding the concept of problem solving involved in stocks & shares, graphs | | | | | | | PO3, PO8 | | | | | |
| **Text Book** | | | | | | | | | | | | | |
| 1 | “QuantitativeAptitude”,R.S.AGGARWAL.,S.Chand&CompanyLtd., | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | |
| 1. |  | | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | | |
| 1. | <https://www.javatpoint.com/aptitude/quantitative> | | | | | | | | | | | | |
| 2. | <https://www.toppr.com/guides/quantitative-aptitude/> | | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** |
| **CO 1** | S |  |  |  |  |  |
| **CO 2** | M | S |  |  |  |  |
| **CO 3** |  |  |  | S |  | S |
| **CO 4** |  |  |  | S | S | M |
| **CO 5** |  |  | S |  |  |  |

**S-Strong M-Medium L-Low**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | | | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | | **External** | **Total** |
|  | **Multimedia Systems** | Specific Elective | Y | - | - | - | | | 2 | 2 | 25 | | 75 | 100 |
| **Course Objective** | | | | | | | | | | | | | | |
| **C1** | Understand the basics of Multimedia | | | | | | | | | | | | | |
| **C2** | To study about the Image File Formats,Sounds Audio File Formats | | | | | | | | | | | | | |
| **C3** | Understand the concepts of Animation and DigitalVideoContainers | | | | | | | | | | | | | |
| **C4** | To study about the Stage of Multimedia Project | | | | | | | | | | | | | |
| **C5** | Understand the concept of OwnershipofContentCreatedforProjectAcquiringTalent | | | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | **No. of Hours** | | | | **Course Objective** | | |
| **I** | Multimedia Definition-Use Of Multimedia-Delivering Multimedia- Text:About Fonts and Faces - Using Text in Multimedia -Computers and Text Font Editing and DesignTools-HypermediaandHypertext. | | | | | | | 12 | | | | C1 | | |
| **II** | Images: Plan Approach - Organize Tools - Configure Computer Workspace -Making Still Images - Color - Image File Formats. Sound: The Power of Sound -DigitalAudio-MidiAudio-Midivs.DigitalAudio-MultimediaSystemSounds Audio File Formats -Vaughan's Law of Multimedia Minimums - Adding SoundtoMultimediaProject | | | | | | | 12 | | | | C2 | | |
| **III** | Animation:The Power of Motion-Principles of Animation-Animation by Computer - Making Animations that Work. Video: Using Video - Working with Video and Displays-DigitalVideoContainers-ObtainingVideo Clips -ShootingandEditingVideo | | | | | | | 12 | | | | C3 | | |
| **IV** | Making Multimedia: The Stage of Multimedia Project - The Intangible Needs -The Hardware Needs - The Software Needs - An Authoring Systems Needs-MultimediaProductionTeam. | | | | | | | 12 | | | | C4 | | |
| **V** | PlanningandCosting:TheProcessofMakingMultimedia-Scheduling-Estimating - RFPs and Bid Proposals. Designing and Producing - Content andTalent:AcquiringContent-OwnershipofContentCreatedforProject-AcquiringTalent | | | | | | | 12 | | | | C5 | | |
|  | **Total** | | | | | | | **60** | | | |  | | |
| **Course Outcomes** | | | | | | | **Programme Outcomes** | | | | | | | |
| **CO** | On completion of this course, students will | | | | | |  | | | | | | | |
| **1** | understand the concepts, importance, application and the process of developing multimedia | | | | | | PO1 | | | | | | | |
| **2** | to have basic knowledge and understanding about image related processings | | | | | | PO1, PO2 | | | | | | | |
| **3** | To understand the framework of frames and bit images to animations | | | | | | PO4, PO6 | | | | | | | |
| **4** | Speaks about the multimedia projects and stages of requirement in phases of project. | | | | | | PO4, PO5, PO6 | | | | | | | |
| **5** | Understanding the concept of cost involved in multimedia planning, designing, and producing | | | | | | PO3, PO8 | | | | | | | |
| **Text Book** | | | | | | | | | | | | | | |
| **1** | TayVaughan,"Multimedia:MakingItWork",8thEdition,Osborne/McGraw-Hill,2001. | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | |
| **1.** | RalfSteinmetz&KlaraNahrstedt"MultimediaComputing,Communication&Applications",PearsonEducation,2012. | | | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | | | |
| **1.** | <https://www.geeksforgeeks.org/multimedia-systems-with-features-or-characteristics/> | | | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** |
| **CO 1** | S |  |  |  |  |  |
| **CO 2** | M | S |  |  |  |  |
| **CO 3** |  |  |  | S |  | S |
| **CO 4** |  |  |  | S | S | M |
| **CO 5** |  |  | S |  |  |  |

**S-Strong M-Medium L-Low**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | | | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | | **External** | **Total** |
|  | **Advanced Excel** | Specific Elective | Y | - | - | - | | | 2 | 2 | 25 | | 75 | 100 |
| **Course Objective** | | | | | | | | | | | | | | |
| C1 | Handle large amounts of data | | | | | | | | | | | | | |
| C2 | Aggregate numeric data and summarize into categories and subcategories | | | | | | | | | | | | | |
| C3 | Filtering, sorting, and grouping data or subsets of data | | | | | | | | | | | | | |
| C4 | Create pivot tables to consolidate data from multiple files | | | | | | | | | | | | | |
| C5 | Presenting data in the form of charts and graphs | | | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | **No. of Hours** | | | | **Course Objective** | | |
| I | Basics of Excel- Customizing common options- Absolute and relative cells- Protecting and un-protecting worksheets and cells- Working with Functions - Writing conditional expressions - logical functions - lookup and reference functions- VlookUP with Exact Match, Approximate Match- Nested VlookUP with Exact Match- VlookUP with Tables, Dynamic Ranges- Nested VlookUP with Exact Match- Using VLookUP to consolidate Data from Multiple Sheets | | | | | | | 6 | | | | C1 | | |
| II | Data Validations - Specifying a valid range of values - Specifying a list of valid values- Specifying custom validations based on formula - Working with Templates Designing the structure of a template- templates for standardization of worksheets - Sorting and Filtering Data -Sorting tables- multiple-level sorting- custom sorting- Filtering data for selected view - advanced filter options- Working with Reports Creating subtotals- Multiple-level subtotal. | | | | | | | 6 | | | | C2 | | |
| III | Creating Pivot tables Formatting and customizing Pivot tables- advanced options of Pivot tables- Pivot charts- Consolidating data from multiple sheets and files using Pivot tables- external data sources- data consolidation feature to consolidate data- Show Value As % of Row, % of Column, Running Total, Compare with Specific Field- Viewing Subtotal under Pivot- Creating Slicers. | | | | | | | 6 | | | | C3 | | |
| IV | More Functions Date and time functions- Text functions- Database functions- Power Functions - Formatting Using auto formatting option for worksheets- Using conditional formatting option for rows, columns and cells- WhatIf Analysis - Goal Seek- Data Tables- Scenario Manager. | | | | | | | 6 | | | | C4 | | |
| V | Charts - Formatting Charts- 3D Graphs- Bar and Line Chart together- Secondary Axis in Graphs- Sharing Charts with PowerPoint / MS Word, Dynamically- New Features Of Excel Sparklines, Inline Charts, data Charts- Overview of all the new features. | | | | | | | 6 | | | | C5 | | |
|  | **Total** | | | | | | | **30** | | | |  | | |
| **Course Outcomes** | | | | | | | **Programme Outcomes** | | | | | | | |
| CO | On completion of this course, students will | | | | | |  | | | | | | | |
| 1 | Work with big data tools and its analysis techniques. | | | | | | PO1 | | | | | | | |
| 2 | Analyze data by utilizing clustering and classification algorithms. | | | | | | PO1, PO2 | | | | | | | |
| 3 | Learn and apply different mining algorithms and recommendation systems for large volumes of data. | | | | | | PO4, PO6 | | | | | | | |
| 4 | Perform analytics on data streams. | | | | | | PO4, PO5, PO6 | | | | | | | |
| 5 | Learn NoSQL databases and management. | | | | | | PO3, PO8 | | | | | | | |
| **Text Book** | | | | | | | | | | | | | | |
| 1 | Excel 2019 All | | | | | | | | | | | | | |
| 2 | Microsoft Excel 2019 Pivot Table Data Crunching | | | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | | | |
| 1. | <https://www.simplilearn.com> | | | | | | | | | | | | | |
| 2 | https://www.javatpoint.com | | | | | | | | | | | | | |
| 3 | https://www.w3schools.com | | | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

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| --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** |
| **CO 1** | S |  |  |  |  |  |
| **CO 2** | M | S |  |  |  |  |
| **CO 3** |  |  |  | S |  | S |
| **CO 4** |  |  |  | S | S | M |
| **CO 5** |  |  | S |  |  |  |

**S-Strong M-Medium L-Low**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | | **Inst. Hours** | **Marks** | | | |
| **CIA** | | **External** | **Total** |
|  | **Biometrics** | Specific Elective | Y | - | - | - | 2 | | 2 | 25 | | 75 | 100 |
| **Course Objectives** | | | | | | | | | | | | | |
| CO1 | Identify the various biometric technologies. | | | | | | | | | | | | |
| CO2 | Design of biometric recognition. | | | | | | | | | | | | |
| CO3 | Develop simple applications for privacy | | | | | | | | | | | | |
| CO4 | Understand the need of biometric in the society | | | | | | | | | | | | |
| CO5 | Understand the scope of biometric techniques | | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | **No. of Hours** | | | **Course Objectives** | | |
| I | |  | | --- | | **Introduction**: What is Biometrics, History,Types of biometric Traits, General architecture of biometric systems, Basic working of biometric matching, Biometric system error and performance measures, Design of biometric system, Applications of biometrics, Biometrics versus traditional authentication methods. |   **Face Biometrics:** Introduction, Background of Face Recognition, Design of Face Recognition System,  Neural Network for Face Recognition, Face Detection in Video Sequences, Challenges in Face Biometrics, .7 Face Recognition Methods, Advantages and Disadvantages. | | | | | | | 6 | | | CO1 | | |
| II | **Retina and Iris Biometrics:** Introduction, Performance of Biometrics, Design of Retina Biometrics, Design of Iris Recognition System, Iris Segmentation Method , Determination of Iris Region, Determination of Iris Region, Applications of Iris Biometrics, Advantages and Disadvantages  **Vein and Fingerprint Biometrics:** Introduction, Biometrics Using Vein Pattern of Palm, Fingerprint Biometrics, Fingerprint Recognition System, Minutiae Extraction, Fingerprint Indexing, Experimental Results, Advantages and Disadvantages. | | | | | | | 6 | | | CO2 | | |
| III | **Privacy Enhancement Using Biometrics:** Introduction, Privacy Concerns Associated with Biometric Deployments, Identity and Privacy, Privacy Concerns, Biometrics with Privacy Enhancement, Comparison of Various Biometrics in Terms of Privacy, Soft Biometrics.  **Multimodal Biometrics:**  Introduction to Multimodal Biometrics , Basic Architecture of Multimodal Biometrics, Multimodal Biometrics Using Face and Ear, Characteristics and Advantages of Multimodal Biometrics, Characteristics and Advantages of Multimodal Biometrics. | | | | | | | 6 | | | CO3 | | |
| IV | **WatermarkingTechniques:** Introduction, Data Hiding Methods, Basic Framework of Watermarking, Classification of Watermarking, Applications of Watermarking, Attacks on Watermarks, Performance Evaluation, Characteristics of Watermarks, General Watermarking Process, Image Watermarking Techniques, Watermarking Algorithm, Experimental Results, Effect of Attacks on Watermarking Techniques, Attacks on Spatial Domain Watermarking. | | | | | | | 6 | | | CO4 | | |
| V | **Scope and Future:** Scope and Future Market of Biometrics, Biometric Technologies, Applications of Biometrics, Biometrics and Information Technology Infrastructure, Role of Biometrics in Enterprise Security, Role of Biometrics in Border Security, Smart Card Technology and Biometrics, Radio Frequency Identification (RFID) Biometrics, DNA Biometrics, Comparative Study of Various Biometric Techniques.  **Biometric Standards:** Introduction, Standard Development Organizations, Application Programming Interface (API), Information Security and Biometric Standards, Biometric Template Interoperability. | | | | | | | 6 | | | CO5 | | |
|  | **Total** | | | | | | | **30** | | |  | | |
| **Course Outcomes** | | | | | | | | | | | | | |
| **Course Outcomes** | On completion of this course, students will; | | | | | | | | | | | | |
| **CO1** | To understand the basic concepts and the functionality of the Biometrics, Face Biometrics, Types, Architecture and Applications. | | | | | | | PO1, PO3, PO6, PO8 | | | | | |
| **CO2** | To know the concepts Retina and Iris Biometrics and Vein and Fingerprint Biometrics. | | | | | | | PO1,PO2,PO3,PO6 | | | | | |
| **CO3** | To analyse the Privacy Enhancement and Multimodal Biometrics. | | | | | | | PO3, PO5 | | | | | |
| **CO4** | To get analyticalidea on Watrmarking Techniques | | | | | | | PO1, PO2, PO3, PO7 | | | | | |
| **CO5** | To Gain knowledge on Future scope of Biometrics,and Study of various Biometric Techniques. | | | | | | | PO2, PO6, PO7 | | | | | |
| **Recommended Text** | | | | | | | | | | | | | |
| 1. | Biometrics: Concepts and Applications by G.R Sinha and SandeepB.Patil , Wiley, 2013 | | | | | | | | | | | | |
| **References Books** | | | | | | | | | | | | | |
| 1. | Guide to Biometrics by Ruud M. Bolle , SharathPankanti, Nalinik.Ratha, Andrew W.Senior, Jonathan H. Connell , Springer 2009 | | | | | | | | | | | | |
| 2. | Introduction to Biometrics by Anil k. Jain, Arun A. Ross, KarthikNandakumar | | | | | | | | | | | | |
| 3. | Hand book of Biometrics by Anil K. Jain, Patrick Flynn, ArunA.Ross. | | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | | |
| 1. | <https://www.tutorialspoint.com/biometrics/index.htm> | | | | | | | | | | | | |
| 2. | <https://www.javatpoint.com/biometrics-tutorial> | | | | | | | | | | | | |
| 3. | <https://www.thalesgroup.com/en/markets/digital-identity-and-security/government/inspired/biometrics> | | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | S |  | M |  |  | L |  | M |
| **CO 2** | S | M | L |  |  | M |  |  |
| **CO 3** |  |  | S |  | M |  |  |  |
| **CO 4** | S | M | M |  |  |  | L |  |
| **CO 5** |  | M |  |  |  | L | M |  |

**S-Strong M-Medium L-Low**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Cyber Forensics** | Specific Elective | Y | - | - | - | 2 | 2 | | 25 | 75 | 100 |
| **Course Objective** | | | | | | | | | | | | |
| **C1** | Understand the definition of computer forensics fundamentals. | | | | | | | | | | | |
| **C2** | To study about the Types of Computer Forensics Evidence | | | | | | | | | | | |
| **C3** | Understand and apply the concepts of Duplication and Preservation of Digital Evidence | | | | | | | | | | | |
| **C4** | Understand the concepts of Electronic Evidence and Identification of Data | | | | | | | | | | | |
| **C5** | To study about the Digital Detective, Network Forensics Scenario, Damaging Computer Evidence. | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | | **No. of Hours** | | **Course Objective** | |
| **I** | **Overview of Computer Forensics Technology:** Computer Forensics Fundamentals: What is Computer Forensics? Use of ComputerForensics in Law Enforcement, Computer Forensics Assistance to HumanResources/Employment Proceedings, Computer Forensics Services, Benefits of professionalForensics Methodology, Steps taken by Computer Forensics Specialists. Types of Computer.Forensics Technology: Types of Business Computer Forensic, Technology–Types ofMilitary Computer Forensic Technology–Types of Law Enforcement–Computer Forensic. Technology–Types of Business Computer Forensic Technology. | | | | | | | | 6 | | C1 | |
| **II** | **Computer Forensics Evidence and capture:** Data Recovery: Data Recovery Defined, Data Back–up and Recovery, The Role of Back –up in Data Recovery, The Data –Recovery Solution. Evidence Collection and Data Seizure: Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collections, Artefacts, Collection Steps, Controlling Contamination: The chain of custody. | | | | | | | | 6 | | C2 | |
| **III** | **Duplication and Preservation of Digital Evidence:** Processing steps, Legal Aspects of collecting and Preserving Computerforensic Evidence. Computer image Verification and Authentication: Special needs of Evidential Authentication, Practical Consideration, Practical Implementation. | | | | | | | | 6 | | C3 | |
| **IV** | **Computer Forensics Analysis:** Discovery of Electronic Evidence: ElectronicDocument Discovery: A Powerful New Litigation Tool. Identification of Data: Time Travel, Forensic Identification and Analysis of Technical Surveillance Devices. | | | | | | | | 6 | | C4 | |
| **V** | **Reconstructing Past Events:** How to Become a Digital Detective, Useable File Formats,Unusable File Formats, Converting Files.Networks: Network Forensics Scenario, a technical approach, Destruction Of E–Mail, Damaging Computer Evidence, DocumentingThe Intrusion on Destruction of Data, System Testing. | | | | | | | | 6 | | C5 | |
|  | **Total** | | | | | | | | **30** | |  | |
| **Course Outcomes** | | | | | | | | | **Programme Outcomes** | | | |
| **CO** | On completion of this course, students will | | | | | | | |  | | | |
| **1** | Understand the definition of computer forensics fundamentals. | | | | | | | | PO1 | | | |
| **2** | Evaluate the different types of computer forensics technology. | | | | | | | | PO1, PO2 | | | |
| **3** | Analyze various computer forensics systems. | | | | | | | | PO4, PO6 | | | |
| **4** | Apply the methods for data recovery, evidence collection and data seizure. | | | | | | | | PO4, PO5, PO6 | | | |
| **5** | Gain your knowledge of duplication and preservation of digital evidence. | | | | | | | | PO3, PO8 | | | |
| **Text Book** | | | | | | | | | | | | |
| **1** | John R. Vacca, “Computer Forensics: Computer Crime Investigation”, 3/E ,Firewall Media, New Delhi, 2002. | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | |
| **1.** | Nelson, Phillips Enfinger, Steuart,“Computer Forensics and Investigations” Enfinger, Steuart, CENGAGE Learning, 2004. | | | | | | | | | | | |
| **2.** | Anthony Sammes and Brian Jenkinson,”Forensic Computing: A Practitioner&#39;s Guide”, Second Edition, Springer–Verlag London Limited, 2007. | | | | | | | | | | | |
| **3.** | .Robert M.Slade,” Software Forensics Collecting Evidence from the Scene of a Digital Crime”, TMH 2005. | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | |
| **1.** | <https://www.vskills.in> | | | | | | | | | | | |
| **2.** | <https://www.hackingarticles.in/best-of-computer-forensics-tutorials/> | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

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| --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** |
| **CO 1** | S |  |  |  |  |  |
| **CO 2** | M | S |  |  |  |  |
| **CO 3** |  |  |  | S |  | S |
| **CO 4** |  |  |  | S | S | M |
| **CO 5** |  |  | S |  |  |  |

**S-Strong M-Medium L-Low**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | | **Credits** | **Inst. Hours** | | **Marks** | | | |
| **CIA** | | **External** | **Total** |
|  | **Pattern Recognition** | Specific Elective | Y | - | - | - | | 2 | 2 | | 75 | | 25 | 100 |
| **Course Objective** | | | | | | | | | | | | | | |
| CO1 | To learn the fundamentals of Pattern Recognition techniques | | | | | | | | | | | | | |
| CO2 | To learn the various Statistical Pattern recognition techniques | | | | | | | | | | | | | |
| CO3 | To learn the linear discriminant functions and unsupervised learning and clustering | | | | | | | | | | | | | |
| CO4 | To learn the various Syntactical Pattern recognition techniques | | | | | | | | | | | | | |
| CO5 | To learn the Neural Pattern recognition techniques | | | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | **No. of Hours** | | | | | **Course Objective** | | |
| I | PATTERN RECOGNITION OVERVIEW: Pattern recognition, Classification and Description-Patterns and feature Extraction with Examples-Training and Learning in PR systems-Pattern recognition Approaches | | | | | | 6 | | | | | CO1 | | |
| II | STATISTICAL PATTERN RECOGNITION: Introduction to statistical Pattern Recognition-supervised Learning using Parametric and Non-Parametric Approaches. | | | | | | 6 | | | | | CO2 | | |
| III | LINEAR DISCRIMINANT FUNCTIONS AND UNSUPERVISED LEARNING AND CLUSTERING: Introduction-Discrete and binary Classification Problems-Techniques to directly Obtain linear Classifiers - Formulation of Unsupervised Learning Problems-Clustering for unsupervised learning and classification | | | | | | 6 | | | | | CO3 | | |
| IV | SYNTACTIC PATTERN RECOGNITION: Overview of Syntactic Pattern Recognition-Syntactic recognition via parsing and other grammars–Graphical Approaches to syntactic pattern recognition-Learning via grammatical inference. | | | | | | 6 | | | | | CO4 | | |
| V | NEURAL PATTERN RECOGNITION: Introduction to Neural Networks-Feedforward Networks and training by Back Propagation-Content Addressable Memory Approaches and Unsupervised Learning in Neural PR | | | | | | 6 | | | | | CO5 | | |
|  | **Total** | | | | | |  | | | | |  | | |
| **Course Outcomes** | | | | | | | | | | **Programme Outcomes** | | | | |
| CO | On completion of this course, students will | | | | | | | | |  | | | | |
| 1 | understand the concepts, importance, application and the process of developing Pattern recognition over view | | | | | | | | | PO1 | | | | |
| 2 | to have basic knowledge and understanding about parametric and non-parametric related concepts. | | | | | | | | | PO1, PO2 | | | | |
| 3 | To understand the framework of frames and bit images to animations | | | | | | | | | PO4, PO6 | | | | |
| 4 | Speaks about the multimedia projects and stages of requirement in phases of project. | | | | | | | | | PO4, PO5, PO6 | | | | |
| 5 | Understanding the concept of cost involved in multimedia planning, designing, and producing | | | | | | | | | PO3, PO8 | | | | |
| **Text Book** | | | | | | | | | | | | | | |
| 1 | Robert Schalkoff, “Pattern Recognition: Statistical Structural and Neural Approaches”, John wiley & sons. | | | | | | | | | | | | | |
| 2 | Duda R.O., P.E.Hart & D.G Stork, “ Pattern Classification”, 2nd Edition, J.Wiley. | | | | | | | | | | | | | |
| 3 | Duda R.O.& Hart P.E., “Pattern Classification and Scene Analysis”, J.wiley. | | | | | | | | | | | | | |
| 4 | Bishop C.M., “Neural Networks for Pattern Recognition”, Oxford University Press. | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | |
| 1. | 1. Earl Gose, Richard johnsonbaugh, Steve Jost, “Pattern Recognition and Image Analysis”, Prentice Hall of India, Pvt Ltd, New Delhi. | | | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | | | |
| 1. | <https://www.geeksforgeeks.org/pattern-recognition-introduction/> | | | | | | | | | | | | | |
| 2. | <https://www.mygreatlearning.com/blog/pattern-recognition-machine-learning/> | | | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | S |  |  |  |  |  |  |  |
| **CO 2** | M | S |  |  |  |  |  |  |
| **CO 3** |  |  |  | S |  | S |  |  |
| **CO 4** |  |  |  | S | S | M |  |  |
| **CO 5** |  |  | S |  |  |  |  | S |

**S-Strong M-Medium L-Low**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
|  | **Enterprise Resource Planning** | Specific Elective | Y | - | - | - | 4 | 4 | 25 | 75 | | 100 |
| **Course Objectives** | | | | | | | | | | | | |
| CO1 | To understand the basic concepts, Evolution and Benefits of ERP. | | | | | | | | | | | |
| CO2 | To know the need and Role of ERP in logical and Physical Integration. | | | | | | | | | | | |
| CO3 | Identify the important business functions provided by typical business software such as enterprise resource planning and customer relationship managemen | | | | | | | | | | | |
| CO4 | To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth | | | | | | | | | | | |
| CO5 | To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | | | | **No. of Hours** | |
| I | ERP Introduction, Benefits, Origin, Evolution and Structure: Conceptual Model of ERP, the Evolution of ERP, the Structure of ERP, Components and needs of ERP, ERP Vendors; Benefits & Limitations of ERP Packages. | | | | | | | | | | 6 | |
| II | Need to focus on Enterprise Integration/ERP; Information mapping; Role of common shared Enterprise database; System Integration, Logical vs. Physical System Integration, Benefits & limitations of System Integration, ERP’s Role in Logical and Physical Integration. Business Process Reengineering, Data ware Housing, Data Mining, Online Analytic Processing (OLAP), Product Life Cycle Man-agement (PLM), LAP, Supply chain Management. | | | | | | | | | | 6 | |
| III | ERP Marketplace and Marketplace Dynamics: Market Overview, Marketplace Dynamics, the Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications. Cloud and Open Source, Management, Material Management, Financial Module, CRM and Case Study. | | | | | | | | | | 6 | |
| IV | ERP Implementation Basics, , ERP implementation Strategy, ERP Implementation Life Cycle ,Pre- Implementation task,Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees. | | | | | | | | | | 6 | |
| V | ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into or-ganizational culture. Using ERP tool: either SAP or ORACLE format to case study. | | | | | | | | | | 6 | |
|  | **Total** | | | | | | | | | | **30** | |
| **Course Outcomes** | | | | | | | | | | | | |
| **Course Outcomes** | On completion of this course, students will; | | | | | | | | | | | |
| **CO1** | Understand the basic concepts of ERP. | | | | | | | | | | | |
| **CO2** | Identify different technologies used in ERP | | | | | | | | | | | |
| **CO3** | Understand and apply the concepts of ERP Manufacturing Perspective and ERP Modules | | | | | | | | | | | |
| **CO4** | Discuss the benefits of ERP | | | | | | | | | | | |
| **CO5** | Apply different tools used in ERP | | | | | | | | | | | |
| **Reference Text :** | | | | | | | | | | | | |
| 1. | Enterprise Resource Planning – Alexis Leon, Tata McGraw Hill. | | | | | | | | | | | |
| **References :** | | | | | | | | | | | | |
| 1. | Enterprise Resource Planning – Diversified by Alexis Leon, TMH. | | | | | | | | | | | |
| 2. | Enterprise Resource Planning – Ravi Shankar & S. Jaiswal , Galgotia | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | |
| 1. | 1. <https://www.tutorialspoint.com/management_concepts/enterprise_resource_planning.htm> | | | | | | | | | | | |
| 2. | 1. <https://www.saponlinetutorials.com/what-is-erp-systems-enterprise-resource-planning/> | | | | | | | | | | | |
| 3. | 1. <https://www.guru99.com/erp-full-form.html> | | | | | | | | | | | |
| 4. | 1. <https://www.oracle.com/in/erp/what-is-erp/> | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

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| --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** |
| **CO 1** | M |  | L |  |  | M |
| **CO 2** | M | S |  |  | L | M |
| **CO 3** |  | L | M |  |  |  |
| **CO 4** |  |  |  | M |  | L |
| **CO 5** | M |  | L |  | M |  |

**S-Strong M-Medium L-Low**

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| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | | **Marks** | | | | |
| **CIA** | | **External** | **Total** | |
|  | **Robotics and Its Applications** | Specific Elective | Y | - | - | - | 2 | 2 | | 25 | | 75 | 100 | |
| **Course Objective** | | | | | | | | | | | | | |
| C1 | To understand the robotics fundamentals | | | | | | | | | | | | |
| C2 | Understand the sensors and matrix methods | | | | | | | | | | | | |
| C3 | Understand the Localization: Self-localizations and mapping | | | | | | | | | | | | |
| C4 | To study about the concept of Path Planning, Vision system | | | | | | | | | | | | |
| C5 | To learn about the concept of robot artificial intelligence | | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | **No. of Hours** | | | | **Course Objective** | | |
| I | Introduction: Introduction, brief history, components of robotics, classification, workspace, work-envelop, motion of robotic arm, end-effectors and its types, service robot and its application, Artificial Intelligence in Robotics. | | | | | | 6 | | | | CO1 | | |
| II | Actuators and sensors :Types of actuators, stepper-DC-servo-and brushless motors- model of a DC servo motor-types of transmissions-purpose of sensor-internal and external sensor-common sensors-encoders tachometers-strain gauge based force torque sensor-proximity and distance measuring sensors  Kinematics of robots: Representation of joints and frames, frames transformation, homogeneous matrix, D-H matrix, Forward and inverse kinematics: two link planar (RR) and spherical robot (RRP). Mobile robot Kinematics: Differential wheel mobile robot | | | | | | 6 | | | | CO2 | | |
| III | Localization: Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems. | | | | | | 6 | | | | CO3 | | |
| IV | Path Planning: Introduction, path planning-overview-road map path planning-cell decomposition path planning potential field path planning-obstacle avoidance-case studies  Vision system: Robotic vision systems-image representation-object recognition-and categorization-depth measurement- image data compression-visual inspection-software considerations | | | | | | 6 | | | | CO4 | | |
| V | Application: Ariel robots-collision avoidance robots for agriculture-mining-exploration-underwater-civilian- and military applications-nuclear applications-space Applications-Industrial robots-artificial intelligence in robots-application of robots in material handling-continuous arc welding-spot welding-spray painting-assembly operation-cleaning-etc. | | | | | | 6 | | | | CO5 | | |
|  | **Total** | | | | | |  | | | |  | | |
| **Course Outcomes** | | | | | | | | | **Programme Outcomes** | | | | |
| CO | On completion of this course, students will | | | | | | | |  | | | | |
| 1 | Describe the different physical forms of robot architectures. | | | | | | | | PO1 | | | | |
| 2 | Kinematically model simple manipulator and mobile robots. | | | | | | | | PO1, PO2 | | | | |
| 3 | Mathematically describe a kinematic robot system | | | | | | | | PO4, PO6 | | | | |
| 4 | Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty. | | | | | | | | PO4, PO5, PO6 | | | | |
| 5 | Program robotics algorithms related to kinematics, control, optimization, and uncertainty. | | | | | | | | PO3, PO8 | | | | |
| **Text Book** | | | | | | | | | | | | | |
| 1 | RicharedD.Klafter. Thomas Achmielewski and MickaelNegin, Robotic Engineering and Integrated Approach, Prentice Hall India-Newdelhi-2001 | | | | | | | | | | | | |
| 2 | SaeedB.Nikku, Introduction to robotics, analysis, control and applications, Wiley-India, 2 nd edition 2011 | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | |
| 1. | Industrial robotic technology-programming and application by M.P.Groover et.al, McGrawhill2008 | | | | | | | | | | | | |
| 2. | Robotics technology and flexible automation by S.R.Deb, THH-2009 | | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | | |
| 1. | <https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm> | | | | | | | | | | | | |
| 2. | <https://www.geeksforgeeks.org/robotics-introduction/> | | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

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|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** |
| **CO 1** | S |  |  |  |  |  |
| **CO 2** | M | S |  |  |  |  |
| **CO 3** |  |  |  | S |  | S |
| **CO 4** |  |  |  | S | S | M |
| **CO 5** |  |  | S |  |  |  |

**S-Strong M-Medium L-Low**

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| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | | **Credits** | **Inst. Hours** | | **Marks** | | | | |
| **CIA** | **External** | **Total** | | | |
|  | **Simulation and Modeling** | Specific Elective | Y | - | - | - | | 4 | 4 | | 25 | 75 | 100 | | | |
| **Course Objectives** | | | | | | | | | | | | | | | |
| CO1 | Generates computer simulation technologies and techniques, lays the groundwork for students to comprehend computer simulation requirements, and implements and tests a variety of simulation and data analysis libraries and programmes. This course focuses on what is required to create simulation software environments rather than just simulations using pre-existing packages | | | | | | | | | | | | | | |
| CO2 | Discuss the concepts of modelling layers of critical infrastructure networks in society. | | | | | | | | | | | | | | |
| CO3 | Create tools for viewing and controlling simulations and their results. | | | | | | | | | | | | | | |
| CO4 | Understand the concept of Entity modelling, Path planning | | | | | | | | | | | | | | |
| CO5 | To learn about the Algorithms and Modelling. | | | | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | **No. of Hours** | | | **Course Objectives** | | | |
| I | Introduction To Modeling & Simulation – What is Modeling and Simulation? – Complexity Types – Model Types – Simulation Types – M&S Terms and Definitions Input Data Analysis – Simulation Input Modeling – Input Data Collection - Data Collection Problems - – Input Modeling Strategy - Histograms -Probability Distributions - Selecting a Probability Distribution. | | | | | | 6 | | | CO1 | | | |
| II | Random Variate Generation – Random Numbers – Random Number Generators – General principles – Inverse Transform Method –Acceptance Rejection Method –Composition Method –Relocate and Rescale Method - Specific distributions-Output Data Analysis – Introduction -Types of Simulation With Respect to Output Analysis - Stochastic Process and Sample Path - Sampling and Systematic Errors - Mean, Standard Deviation and Confidence Interval - Analysis of Finite-Horizon Simulations - Single Run - Independent Replications - Sequential Estimation – Analysis of Steady-State Simulations - Removal oInitialization Bias (Warm-up Interval) - Replication-Deletion Approach - Batch-Means Method . | | | | | | 6 | | | CO2 | | | |
| III | Comparing Systems via Simulation – Introduction – Comparison Problems - Comparing Two Systems - Screening Problems - Selecting the Best - Comparison with a Standard - Comparison with a Fixed Performance Discrete Event Simulations – Introduction - Next-Event Time Advance - Arithmetic and Logical Relationships - Discrete-Event Modeling Approaches – Event-Scheduling Approach – Process Interaction Approach. | | | | | | 6 | | | CO3 | | | |
| IV | Entity Modeling – Entity Body Modeling – Entity Body Visualization – Entity Body Animation – Entity Interaction Modeling – Building Modeling Distributed Simulation – High Level Architecture (HLA) – Federation Development and Execution Process (FEDEP) – SISO RPR FOM Behavior Modeling – General AI Algorithms - Decision Trees - Neural Networks - Finite State Machines - Logic Programming - Production Systems – Path Planning - Off-Line Path Planning - Incremental Path Planning - Real-Time Path Planning – Script Programming -Script Parsing - Script Execution. | | | | | | 6 | | | CO4 | | | |
| V | Optimization Algorithms – Genetic Algorithms – Simulated Annealing Examples: Sensor Systems Modeling – Human Eye Modeling – Optical Sensor Modeling – Radar Modeling. | | | | | | 6 | | | CO5 | | | |
|  | **Total** | | | | | | **30** | | |  | | | |
| **Course Outcomes** | | | | | | | | | | | | | | | |
| **Course Outcomes** | On completion of this course, students will; | | | | | | **Programme Outcomes** | | | | | | | |
| **CO1** | Introduction To Modeling & Simulation, Input Data Analysis and Modeling. | | | | | | PO1 | | | | | | | |
| **CO2** | Random Variate and Number Generation. Analysis of Simulations and methods. | | | | | | PO1, PO2 | | | | | | | |
| **CO3** | Comparing Systems via Simulation | | | | | | PO4, PO6 | | | | | | | |
| **CO4** | Entity Body Modeling, Visualization, Animation. | | | | | | PO4, PO5, PO6 | | | | | | | |
| **CO5** | Algorithms and Sensor Modeling. | | | | | | PO3, PO8 | | | | | | | |
| **Text Books** | | | | | | | | | | | | | | | |
| 1. | Jerry Banks, “Handbook of Simulation: Principles, Methodology, Advances, Applications, and Practice”, John Wiley & Sons, Inc., 1998. | | | | | | | | | | | | | | |
| 2. | George S. Fishman, “Discrete-Event Simulation: Modeling, Programming and Analysis”, Springer-Verlag New York, Inc., 2001. | | | | | | | | | | | | | | |
| **References Books** | | | | | | | | | | | | | | | |
| 1. | Andrew F. Seila, Vlatko Ceric, Pandu Tadikamalla, “Applied Simulation Modeling”, Thomson Learning Inc., 2003. | | | | | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | | | | |
| 1. | <https://www.tutorialspoint.com/modelling_and_simulation/index.htm> | | | | | | | | | | | | | | |
| 2. | <https://www.javatpoint.com/verilog-simulation-basics> | | | | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

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|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | S |  |  |  |  |  |  |  |
| **CO 2** | M | S |  |  |  |  |  |  |
| **CO 3** |  |  |  | S |  | S |  |  |
| **CO 4** |  |  |  | S | S | M |  |  |
| **CO 5** |  |  | S |  |  |  |  | S |

**S-Strong(3) M-Medium (2) L-Low (1)**

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| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **O** | **Credits** | **Inst. Hours** | **Marks** | | | |
| **CIA** | | **External** | **Total** |
|  | **Organizational Behaviour** | Specific Elective | Y | - | - | - | 2 | 2 | 25 | | 75 | 100 |
| **Learning Objectives** | | | | | | | | | | | | |
| LO1 | To have extensive knowledge onOB and the scope of OB. | | | | | | | | | | | |
| LO2 | To create awareness of Individual Benaviour. | | | | | | | | | | | |
| LO3 | To enhance the understanding of Group Behaviour | | | | | | | | | | | |
| LO4 | To know the basics of Organisaitonal Culture and Organisational Structure | | | | | | | | | | | |
| LO5 | To understand Organisational Change, Conflict and Power | | | | | | | | | | | |
| **UNIT** | **Details** | | | | | | | | | **No. of Hours** | | |
| I | INTRODUCTION : Concept of Organizational Behavior (OB): Nature, Scope and Role of OB: Disciplines that contribute to OB; Opportunities for OB (Globalization, Indian workforce diversity, customer service, innovation and change, networked organizations, work-life balance, people skills, positive work environment, ethics) | | | | | | | | | 6 | | |
| II | INDIVIDUAL BEHAVIOUR:  1. Learning, attitude and Job satisfaction: Concept of learning, conditioning, shaping and reinforcement. Concept of attitude, components, behavior and attitude. Job satisfaction: causation; impact of satisfied employees on workplace.  2. Motivation : Concept; Theories (Hierarchy of needs, X and Y, Two factor, McClelland, Goal setting, Self-efficacy, Equity theory); Job characteristics model; Redesigning jobs,  3. Personality and Values : Concept of personality; Myers-Briggs Type Indicator (MBTI); Big Five model. Relevance of values; Linking personality and values to the workplace (person-job fit, person-organization fit)  4. Perception, Decision Making : Perception and Judgements; Factors; Linking perception to individual decision making: | | | | | | | | | 6 | | |
| III | GROUP BEHAVIOUR : 1. Groups and Work Teams : Concept : Five Stage model of group development; Group norms, cohesiveness ; Group think and shift ; Teams; types of teams; Creating team players from individuals and team based work(TBW) 2. Leadership : Concept; Trait theories; Behavioral theories (Ohio and Michigan studies); Contingency theories (Fiedler, Hersey and Blanchard, Path-Goal); | | | | | | | | | 6 | | |
| IV | ORGANISATIONAL CULTURE AND STRUCTURE : Concept of culture; Impact (functions and liability); Creating and sustaining culture: Concept of structure, Prevalent organizational designs: New design options | | | | | | | | | 6 | | |
| V | ORGANISATIONAL CHANGE, CONFLICT AND POWER: Forces of change; Planned change; Resistance; Approaches (Lewin's model, Organisational development);. Concept of conflict, Conflict process; Types, Functional/ Dysfunctional. Introduction to power and politics. | | | | | | | | | 6 | | |
|  |  | | | | | | | | | **30** | | | |
| **Course Outcomes** | On Completion of the course the students will | | | | | | | | | | | |
| **CO1** | To define OrganisationalBehaviour, Understand the opportunity through OB. | | | | | | | | | | | |
| **CO2** | To apply self-awareness, motivation, leadership and learning theories at workplace. | | | | | | | | | | | |
| **CO3** | To analyze the complexities and solutions of group behaviour. | | | | | | | | | | | |
| **CO4** | To impact and bring positive change in the culture of the organisaiton. | | | | | | | | | | | |
| **CO5** | To create a congenial climate in the organization. | | | | | | | | | | | |
| **Reading List** | | | | | | | | | | | | |
| 1. | [NeharikaVohra Stephen P. Robbins, Timothy A. Judge](https://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Neharika+Vohra+Stephen+P.+Robbins%2C+Timothy+A.+Judge&search-alias=stripbooks) , *Organizational Behaviour*, Pearson Education, 18th Edition, 2022. | | | | | | | | | | | |
| 2. | Fred Luthans, *Organizational Behaviour*, Tata McGraw Hill, 2017. | | | | | | | | | | | |
| 3. | Ray French, Charlotte Rayner, Gary Rees & Sally Rumbles, *Organizational Behaviour*, John Wiley & Sons, 2011 | | | | | | | | | | | |
| 4. | [Louis Bevoc](https://www.amazon.in/Louis-Bevoc/e/B071SKMB82/ref=dp_byline_cont_ebooks_1), [Allison Shearsett](https://www.amazon.in/s/ref=dp_byline_sr_ebooks_2?ie=UTF8&field-author=Allison+Shearsett&text=Allison+Shearsett&sort=relevancerank&search-alias=digital-text), [Rachael Collinson](https://www.amazon.in/s/ref=dp_byline_sr_ebooks_3?ie=UTF8&field-author=Rachael+Collinson&text=Rachael+Collinson&sort=relevancerank&search-alias=digital-text), *Organizational Behaviour Reference*, Nutri Niche System LLC (28 April 2017) | | | | | | | | | | | |
| 5. | Dr. Christopher P. Neck, Jeffery D. Houghton and Emma L. Murray, *Organizational Behaviour: A Skill-Building Approach,* SAGE Publications, Inc; 2nd edition (29 November 2018). | | | | | | | | | | | |
| **References Books** | | | | | | | | | | | | |
| 1. | Uma Sekaran, Organizational Behaviour Text & cases, 2nd edition, Tata McGraw Hill Publishing CO. Ltd | | | | | | | | | | | |
| 2. | GangadharRao, Narayana, V.S.P Rao, Organizational Behaviour 1987, Reprint 2000, Konark Publishers Pvt. Ltd, 1st edition | | | | | | | | | | | |
| 3. | S.S. Khanka, Organizational Behaviour, S. Chand & Co, New Delhi. | | | | | | | | | | | |
| 4. | J. Jayasankar, Organizational Behaviour, Margham Publications, Chennai, 2017. | | | | | | | | | | | |

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|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | S |  |  |  |  |  |  |  |
| **CO 2** | M | S |  |  |  |  |  |  |
| **CO 3** |  |  |  | S |  | S |  |  |
| **CO 4** |  |  |  | S | S | M |  |  |
| **CO 5** |  |  | S |  |  |  |  | S |