**APPENDIX – BB**

# MADURAIKAMARAJUNIVERSITY

***(University with Potential for Excellence)***

**B.Sc.ComputerScience (Semester)**

**CHOICE BASED CREDIT SYSTEMREVISEDSYLLABUS**

**(With effect from 2023-24)**

**SCHEME OF EXAMINATIONS, REGULATIONS AND SYLLABUS**

1. **Course objectives :**

- To prepare the students to manage the software components in a computer independently and to be a Programmer.
- To motivate the students to take up higher studies in Computer Scienceandotherstreams.

2. **Eligibility for Admission:**

A candidate should have studied +2 level Mathematics as one of the subjects in the 10 +2 stream.

3. **Duration of the Course:**

The students shall undergo the prescribed course of study for a period of notlessthan three academic years(Six semesters).

4. **Medium of Instruction:**English.

5. **Eligibility for the Degree:**

- A Candidate shall be eligible for the award of the degree on completion of theprescribed course of study and passing all the prescribed externalexaminations.
- Attendance progress, internal examinations, conduct certificate from the Head of the Institution shall be required for taking the external examination.
- The passing minimum and the ranking are as per the existing rule of the Choice Based Credit System for the affiliated college of the University.

# 1. Introduction

**B.Sc. Computer Science**

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.

Programme Outcome, Programme Specific Outcome and Course Outcome

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. The key core areas of study in Mathematics include Algebra, Analysis (Real & Complex), Differential Equations, Geometry, and Mechanics. 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.

**2. Programme Outcomes (PO) of B.Sc. degree programme in Computer Science**

- Scientific aptitude will be developed in Students
- Students will acquire basic Practical skills & Technical knowledge along with domain knowledge of different subjects in the Computer Science & humanities stream.
- Students will become employable; Students will be eligible for career opportunities in education field, Industry, or will be able to opt for entrepreneurship.
- Students will possess basic subject knowledge required for higher studies, professional and applied courses.
- Students will be aware of and able to develop solution oriented approach towards various Social and Environmental issues.
- Ability to acquire in-depth knowledge of several branches of Computer Science and aligned areas. This Programme helps learners in building a solid foundation for higher studies in Computer Science and applications.
- The skills and knowledge gained leads to proficiency in analytical reasoning, which can be utilized in modelling and solving real life problems.
- Utilize computer programming skills to solve theoretical and applied problems by critical understanding, analysis and synthesis.
- To recognize patterns and to identify essential and relevant aspects of problems.
- Ability to share ideas and insights while seeking and benefitting from knowledge and insight of others.
- Mould the students into responsible citizens in a rapidly changing interdependent society.

The above expectations generally can be pooled into 6 broad categories and can be modified according to institutional requirements:

PO1: Knowledge

PO2: Problem Analysis

PO3: Design / Development of Solutions

PO4: Conduct investigations of complex problems

PO5: Modern tool usage

PO6: Applying to society

**3. Programme Specific Outcomes of B.Sc. Degree Programme in Computer Science**

PSO1: Think in a critical and logical based manner

PSO2: Familiarize the students with suitable software tools of computer science and industrial applications to handle issues and solve problems in mathematics or statistics and realtime application related sciences.

PSO3: Know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand.

PSO4: Understand, formulate, develop programming model with logical approaches to a Address issues arising in social science, business and other contexts.

PSO5: Acquire good knowledge and understanding to solve specific theoretical and applied problems in advanced areas of Computer science and Industrial statistics.

PSO6: Provide students/learners sufficient knowledge and skills enabling them to undertake further studies in Computer Science or Applications or Information Technology and its allied areas on multiple disciplines linked with Computer Science.

PSO7: Equip with Computer science technical ability, problem solving skills, creative talent and power of communication necessary for various forms of employment.

PSO8: Develop a range of generic skills helpful in employment, internships& societal activities.

PSO9: Get adequate exposure to global and local concerns that provides platform for further exploration into multi-dimensional aspects of computing sciences.

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) can be carried out accordingly, assigning the appropriate level in the grids: (put tick mark in each row)

| **PO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** | **PSO6** |
|---|---|---|---|---|---|---|
| **PO1** | ✓ | | | | | |
| **PO2** | | ✓ | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **PO3** | | | ✓ | | | |
| **PO4** | | | | ✓ | | |
| **PO5** | | | | | ✓ | |
| **PO6** | | | | | | ✓ |

**4. 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 Computer Science 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 – Statistics with R Programming, Data Science, Machine learing. Internet of Things and Artificial Intelligence etc..

**5. Value additions in the Revamped Curriculum:**

| Semester | Newly introduced Components | Outcome / Benefits |
|---|---|---|
| **I** | **Foundation Course**<br>To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning abstract Mathematics and simulating mathematical concepts to real world. | • Instil confidence among students<br>• Create interest for the subject |
| **I, II, III, IV** | **Skill Enhancement papers** (Discipline centric / Generic / Entrepreneurial) | • Industry ready graduates<br>• Skilled human resource<br>• Students are equipped with essential skills to make them employable |
| | | • Training on Computing / Computational skills enable the students gain knowledge and exposure on latest computational aspects |
| | | • Data analytical skills will enable students gain internships, apprenticeships, field work involving data collection, compilation, analysis etc. |
| | | • Entrepreneurial skill training will provide an opportunity for independent livelihood<br>• Generates self – employment<br>• Create small scale entrepreneurs<br>• Training to girls leads to women empowerment |
| | | • Discipline centric skill will improve the Technical knowhow of solving real life problems using ICT tools |
| **III, IV, V & VI** | Elective papers-<br>An open choice of topics categorized under Generic and Discipline Centric | • Strengthening the domain knowledge<br>• Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature<br>• Students are exposed to Latest topics on Computer Science / IT, that require strong mathematical background<br>• Emerging topics in higher education / industry / communication network / health sector etc. are |

| | | |
|---|---|---|
| | | introduced with hands-on-training, facilitates designing of mathematical models in the respective sectors |
| **IV** | Industrial Statistics | • Exposure to industry moulds students into solution providers<br>• Generates Industry ready graduates<br>• Employment opportunities enhanced |
| **II year Vacation activity** | Internship / Industrial Training | • Practical training at the Industry/ Banking Sector / Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens. |
| **V Semester** | Project with Viva – voce | • Self-learning is enhanced<br>• Application of the concept to real situation is conceived resulting in tangible outcome |
| **VI Semester** | Introduction of Professional Competency component | • Curriculum design accommodates all category of learners; 'Mathematics for Advanced Explain' component will comprise of advanced topics in Mathematics and allied fields, for those in the peer group / aspiring researchers;<br>• 'Training for Competitive Examinations' –caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, CDS, NDA, Banking Services, CAT, TNPSC group services, etc. |
| **Extra Credits:**<br>**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** | | | | | | | | | | | | | | | | | |

# B.Sc Computer Science
# 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 has to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.**

| MethodsofEvaluation | | |
|---|---|---|
| **Internal Evaluation** | ContinuousInternalAssessmentTest | 25 Marks |
| | Assignments | |
| | Seminars | |
| | AttendanceandClassParticipation | |
| **External Evaluation** | EndSemesterExamination | 75 Marks |
| | Total | 100 Marks |
| **MethodsofAssessment** | | |
| **Recall(K1)** | Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions | |
| **Understand/Comprehend(K2)** | MCQ,True/False,Shortessays,Conceptexplanations,Shortsummaryor Overview | |
| **Application (K3)** | Suggestidea/conceptwithexamples,Suggestformulae, Solveproblems, Observe,Explain | |
| **Analyze(K4)** | Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiate | |
| | betweenvariousideas,Mapknowledge | |
| **Evaluate(K5)** | Longer essay/Evaluationessay,Critiqueorjustifywithprosandcons | |
| **Create(K6)** | Checkknowledgeinspecificoroffbeatsituations,Discussion,Debatingor Presentations | |

## B.Sc. Computer Science Curriculum

## First Year

### Semester-I

| Part | List of Courses | Credit | Hours per week (L/T/P) | Internal Marks | External Marks |
|---|---|---|---|---|---|
| Part-I | Language – Tamil | 3 | 6 | 25 | 75 |
| Part-II | English | 3 | 6 | 25 | 75 |
| Part-III | CC1 - Programming in C | 5 | 5 | 25 | 75 |
| | CC2 - Practical : Programming in C Lab | 5 | 5 | 25 | 75 |
| | Elective Course 1 -Discrete Mathematics – I – EC1(Annexure I) (Generic / Discipline Specific) | 3 | 4 | 25 | 75 |
| Part-IV | Skill Enhancement Course- SEC-1 - Fundamentals of Information Technology (Annexure II) -(Non Major Elective) | 2 | 2 | 25 | 75 |
| | Foundation Course FC - Problem Solving Techniques | 2 | 2 | 25 | 75 |
| | | **23** | **30** | | |

### Semester-II

| Part | List of Courses | Credit | Hours per week(L/T/P) | Internal Marks | External Marks |
|---|---|---|---|---|---|
| Part-I | Language –Tamil | 3 | 6 | 25 | 75 |
| Part-II | English | 3 | 6 | 25 | 75 |
| Part-III | CC3 - Data Structures and Algorithms | 5 | 5 | 25 | 75 |
| | CC4 - Practical: Data Structures and Algorithms Lab(C++) | 5 | 5 | 25 | 75 |
| | Elective Course 2 - Numerical Methods – EC2(Annexure I) (Generic / Discipline Specific) | 3 | 4 | 25 | 75 |
| Part-IV | Skill Enhancement Course- SEC-2 - Office Automation(Annexure II) -(Non Major Elective) | 2 | 2 | 25 | 75 |
| | Skill Enhancement Course – SEC-3 - Advanced Excel (Annexure II) - (Discipline Specific / Generic) | 2 | 2 | 25 | 75 |
| | | **23** | **30** | | |

**Second Year**
**Semester-III**

| Part | List of Courses | Credit | Hours per week(L/T/P) | Internal Marks | External Marks |
|---|---|---|---|---|---|
| Part-I | Language – Tamil | 3 | 6 | 25 | 75 |
| Part-II | English | 3 | 6 | 25 | 75 |
| Part-III | CC5- Python Programming | 5 | 5 | 25 | 75 |
| | CC6 - Practical : Python Programming Lab | 5 | 5 | 25 | 75 |
| | Elective Course 3 - Statistical Methods and its Application-I- EC3 (Annexure I) (Generic / Discipline Specific) | 3 | 4 | 25 | 75 |
| Part-IV | Skill Enhancement Course -SEC-4 - Multimedia Systems (Annexure II) (Entrepreneurial Based) | 1 | 1 | 25 | 75 |
| | Skill Enhancement Course -SEC-5 - PHP Programming (Annexure II) (Discipline Specific/ Generic) | 2 | 2 | 25 | 75 |
| | Environmental Studies | - | 1 | | |
| | | **22** | **30** | | |

**Semester-IV**

| Part | List of Courses | Credit | Hours per week (L/T/P) | Internal Marks | External Marks |
|---|---|---|---|---|---|
| Part-I | Language – Tamil | 3 | 6 | 25 | 75 |
| Part-II | English | 3 | 6 | 25 | 75 |
| Part-III | CC7 - Java Programming | 5 | 5 | 25 | 75 |
| | CC8 - Practical: Java Programming Lab | 5 | 5 | 25 | 75 |
| | Elective Course - EC4 - Resource Management Techniques/ Digital Logic Fundamentals (Annexure I) - (Generic / Discipline Specific) | 3 | 3 | 25 | 75 |
| Part-IV | Skill Enhancement Course – SEC-6 - Web Designing-(Annexure II) | 2 | 2 | 25 | 75 |
| | Skill Enhancement Course - SEC-7 – Software Testing-(Annexure II) | 2 | 2 | 25 | 75 |
| | Environmental Studies | 2 | 1 | 25 | 75 |
| | | **25** | **30** | | |

**Third Year**
**Semester-V**

| Part | List of Courses | Credit | Hours per week (L/T/P) | Internal Marks | External Marks |
|---|---|---|---|---|---|
| Part-III | CC9 - Software Engineering | 4 | 5 | 25 | 75 |
| | CC10 - Database Management System | 4 | 5 | 25 | 75 |
| | CC11 - Practical: Database Management System Lab | 4 | 5 | 25 | 75 |
| | Elective Course – EC5-Operating Systems – (Annexure I) (Generic / Discipline Specific) | 3 | 4 | 25 | 75 |
| | Elective Course – EC6- Big Data Analytics – (Annexure I) (Generic / Discipline Specific) | 3 | 4 | 25 | 75 |
| | CC12 - Core /Project with Viva voce | 4 | 5 | 25 | 75 |
| Part-IV | Value Education | 2 | 2 | 25 | 75 |
| | Internship / Industrial Training (Summer vacation at the end of IV semester activity) | 2 | - | | |
| | | **26** | **30** | | |

**Semester-VI**

| Part | List of Courses | Credit | Hours per week (L/T/P) | Internal Marks | External Marks |
|---|---|---|---|---|---|
| Part-III | CC13 - Computer Networks | 4 | 6 | 25 | 75 |
| | CC14 - .NET Programming | 4 | 6 | 25 | 75 |
| | CC15 - Practical: .NET Programming Lab | 4 | 6 | 25 | 75 |
| | Elective Course – EC7- Image Processing – (Annexure I) (Generic / Discipline Specific) | 3 | 5 | 25 | 75 |
| | Elective Course – EC8- Artificial Intelligence – (Annexure I) (Generic / Discipline Specific) | 3 | 5 | 25 | 75 |
| Part-IV | Professional Competency Skill Enhancement Course SEC8- Data Analytics using R Lab – (Annexure I) | 2 | 2 | 25 | 75 |
| Part -V | Extension Activity | 1 | - | - | - |
| | | **21** | **30** | | |

**Total Credits: 140**

# Annexure I

## Suggested topics in Core component

1. Programming in C
2. Programming in C Lab
3. Object oriented Programming using C++
4. Object oriented Programming using C++ Lab
5. Mobile Application Development
6. Mobile Application Development Lab
7. Data Analytics using R
8. Data Analytics using RLab
9. Machine Learning
10. Machine Learning Lab
11. Data Mining and Warehousing
12. Software Metrics
13. Network Security

## 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. Digital Logic Fundamentals
6. Numerical Methods
7. Optimization Techniques
8. Nano Technology
9. Introduction to Linear Algebra
10. Graph Theory and its Application
11. Resource Management Techniques and more

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

1. Natural Language Processing
2. Analytics for Service Industry
3. Cryptography
4. RDBMS with PL/SQL
5. Big Data Analytics
6. IOT and its Applications
7. Software Project Management

8. Image Processing
9. Human Computer Interaction
10. Fuzzy Logic
11. Artificial Intelligence
12. Robotics and its Applications
13. Computational Intelligence
14. Cloud Computing
15. Artificial Neural Network
16. Introduction to Data Science
17. Agile Project Management
18. Virtual Reality
19. Operating systemand more

# Annexure II

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

**Skill Enhancement Course**

1. Fundamentals of Information Technology
2. Introduction to HTML
3. Web Designing
4. PHP Programming
5. Software Testing
6. Understanding Internet
7. Office Automation
8. Quantitative Aptitude
9. Multimedia Systems
10. Advanced Excel
11. Biometrics
12. Cyber Forensics
13. Pattern Recognition
14. Enterprise Resource Planning
15. Simulation and Modelling
16. Organization Behavior and more

# FIRST SEMESTER

## CORE PAPER

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| **CC1** | **PROGRAMMING IN C** | Core | 5 | - | - | - | 4 | 5 | 25 | 75 | 100 |

| **Learning Objective** | |
|---|---|
| LO1 | To familiarize the students with the Programming basics and the fundamentals of C, Datatypes in C, Mathematical and logical operations. |
| LO2 | To understand the concept using if statements and loops |
| LO3 | This unit covers the concept of Arrays and Functions |
| LO4 | This unit covers the concept of Structurs and unions and Preprocessors |
| LO5 | To understand the concept of implementing pointers. |

| UNIT | Contents | No. of Hours |
|---|---|---|
| I | **Overview of C**: Importance of C, sample C program, C program structure, executing C program.<br>Constants, Variables, and Data Types: Character set, C tokens, keywords and identifiers, constants, variables, data types, declaration of variables, Assigning values to variables---Assignment statement, declaring a variable as constant, as volatile.<br>**Operators and Expression**: Arithmetic, Relational, logical, assignment, increment, decrement, conditional, bitwise and special operators, arithmetic expressions, operator precedence, type conversions, mathematical functions<br>**Managing Input and Output Operators**: Reading and writing a character, formatted input, formatted output. | 15 |
| II | **Decision Making and Branching**: Decision making with If, simple IF, IF ELSE, nested IF ELSE , ELSE IF ladder, switch, GOTO statement.<br>**Decision Making and Looping**: While, Do-While, For, Jumps in loops. | 15 |

| | | |
|---|---|---|
| III | **Arrays**: Declaration and accessing of one & two-dimensional arrays, initializing two-dimensional arrays, multidimensional arrays.<br>**Functions**: The form of C functions, Return values and types, calling a function, categories of functions, Nested functions, Recursion, functions with arrays, call by value, call by reference, storage classes-character arrays and string functions. | 15 |
| IV | **Structures and Unions**: Defining, giving values to members, initialization and comparison of structure variables, arrays of structure, arrays within structures, structures within structures, structures and functions, unions.<br>**Preprocessors**: Macro substitution, file inclusion. | 15 |
| V | **Pointers:** definition, declaring and initializing pointers, accessing a variable through address and through pointer, pointer expressions, pointer increments and scale factor, pointers and arrays, pointers and functions, pointers and structures. | 15 |
| | **Total** | **75** |

| **Course Outcomes** | | **Programme Outcome** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Remember the program structure of C with its syntax and semantics | PO1,PO3,PO5 |
| CO2 | Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files) | PO2,PO3,PO6 |
| CO3 | Apply the programming principles learnt in real-time problems | PO3,PO4,PO5 |
| CO4 | Analyze the various methods of solving a problem and choose the best method | PO4,PO5,PO6 |
| CO5 | Code, debug and test the programs with appropriate test cases | PO5,PO6 |

| **Text Book** | |
|---|---|
| 1 | E. Balagurusamy, Programming in ANSI C, Fifth Edition, Tata McGraw-Hill, 2010. |
| **Reference Books** | |
| 1. | Byron Gottfried, Schaum's Outline Programming with C, Fourth Edition, Tata |

| | |
|---|---|
| | McGraw-Hill, 2018. |
| 2. | Kernighan and Ritchie, The C Programming Language, Second Edition, Prentice Hall, 1998 |
| 3. | YashavantKanetkar, Let Us C, Eighteenth Edition, BPB Publications,2021 |
| **Web Resources** | |
| 1. | https://codeforwin.org/ |
| 2. | https://www.geeksforgeeks.org/c-programming-language/ |
| 3. | http://en.cppreference.com/w/c |
| 4. | http://learn-c.org/ |
| 5. | https://www.cprogramming.com/ |

**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 | 2 | 3 | 3 |
| **CO 3** | 2 | 3 | 2 | 3 | 3 | 2 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 5** | 3 | 3 | 3 | 3 | 3 | 2 |
| **Weight age of course contributed to each PSO** | 14 | 15 | 14 | 14 | 15 | 13 |

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 |
| **CC 2** | **PROGRAMMING IN C LAB** | Core | - | - | 4 | - | 4 | 4 | 25 | 75 | 100 |

| **Course Objective** | |
|---|---|
| LO1 | To familiarize the students with the Programming basics and the fundamentals of C, Datatypes in C, Mathematical and logical operations. |
| LO2 | To understand the concept using if statements and loops |
| LO3 | This unit covers the concept of Arrays and Functions |
| LO4 | This unit covers the concept of Structurs and unions and Preprocessors |
| LO5 | To understand the concept of implementing pointers and files |

| **UNIT** | **List of Excercises** | **No. of Hours** | **Course Objectives** |
|---|---|---|---|
| I | **Unit I : Variables, Data types, Constants and Operators**<br>1.Evaluation of expression ex: ((x+y) ^2 * (x+z))/w<br>2.Temperature conversion problem (Fahrenheit to Celsius)<br>3.Program to convert days to months and days (Ex: 364 days = 12 months and 4 days)<br>4.Solution of quadratic equation<br>5.Salesman salary (Given: Basic Salary, Bonus for every item sold, commission on the total monthly sales) | 12 | |
| II | **Unit II: Decision making Statements**<br>6.Maximum of three numbers<br>7.Calculate Square root of five numbers (using gototatement)<br>8.Pay-Bill Calculation for different levels of employee (Switch statement)<br>9. Fibonacci series<br>10.Floyds Triangle<br>11.Pascal's Triangle | 12 | |

| | | |
|---|---|---|
| III | **Unit III: Arrays, Functions and Strings**<br>12.Prime numbers in an array<br>13.Sorting data (Ascending and Descending)<br>14.Matrix Addition and Subtraction<br>15.Matrix Multiplication<br>16.Function with no arguments and no return values<br>17.Function that convert lower case letters to upper case<br>18. Factorial using recursion.<br>19.Perform String Operations using Switch Case. | 12 |
| IV | **Unit IV : Structures and Macros**<br>20.Structure that describes a Hotel (name, address, grade, avg room rent, number of rooms) Perform some operations (list of hotels of a given grade etc.)<br>21. Using Pointers in Structures.<br>22.Cricket team details using Union.<br>23.Write a macro that calculates the max and min of two numbers<br>24.Nested macro to calculate Cube of a number. | 12 |
| V | **Unit V : Pointers and Files**<br>25.Evaluation of Pointer expressions<br>26.Function to exchange two pointer values<br>27.Creation, insertion and deletion in a linked list<br>28.Program to read a file and print the data.<br>29.Program to receive a file name and a line of text as command line arguments and write the text to the file<br>30. Program to copy the content of one file to another file. | 12 |
| | **Total** | **60** |

| Course Outcomes | | Programme Outcome |
|---|---|---|
| CO | On completion of this course, students will | |
| 1 | Remember the program structure of C with its syntax and semantics | PO1,PO3,PO5 |
| 2 | Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files) | PO2,PO3,PO6 |
| 3 | Apply the programming principles learnt in real-time problems | PO3,PO4 |
| 4 | Analyze the various methods of solving a problem and choose the best method | PO4,PO5,PO6 |
| 5 | Code, debug and test the programs with appropriate test cases | PO4,PO6 |
| **Text Book** | | |
| 1 | E. Balagurusamy, Programming in ANSI C, Fifth Edition, Tata McGraw-Hill, 2010. | |
| **Reference Books** | | |
| 1. | Byron Gottfried, Schaum's Outline Programming with C, Fourth Edition, Tata McGraw-Hill, 2018. | |
| 2. | Kernighan and Ritchie, The C Programming Language, Second Edition, Prentice Hall, 1998 | |
| 3. | YashavantKanetkar, Let Us C, Eighteenth Edition, BPB Publications,2021 | |
| **Web Resources** | | |
| 1. | https://codeforwin.org/ | |
| 2. | https://www.geeksforgeeks.org/c-programming-language/ | |
| 3. | http://en.cppreference.com/w/c | |
| 4. | http://learn-c.org/ | |
| 5. | https://www.cprogramming.com/ | |

**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 |
| **Weight age of course contributed to each PSO** | 14 | 15 | 14 | 15 | 15 | 14 |

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 |
| **FC** | **Problem Solving Techniques** | FC | 2 | - | - | - | 2 | 2 | 25 | 75 | 100 |

| **Learning Objectives** | |
|---|---|
| LO1 | Familiarize with writing of algorithms, fundamentals of C and philosophy of problem solving. |
| LO2 | Implement different programming constructs and decomposition of problems into functions. |
| LO3 | Use data flow diagram, Pseudo code to implement solutions. |
| LO4 | Define and use of arrays with simple applications |
| LO5 | Understand about operating system and their uses |

| UNIT | Contents | No. Of. Hours |
|---|---|---|
| I | **Introduction:** History, characteristics and limitations of Computer. Hardware/Anatomy of Computer: CPU, Memory, Secondary storage devices, Input Devices and Output devices. Types of Computers: PC, Workstation, Minicomputer, Main frame and Supercomputer. Software: System software and Application software. **Programming Languages:** Machine language, Assembly language, High-level language,4 GL and 5GL-Features of good programming language. Translators: Interpreters and Compilers. | **6** |

| | | |
|---|---|---|
| II | **Data:** Data types, Input, Processing of data, Arithmetic Operators, Hierarchy of operations and Output. Different phases in Program Development Cycle (PDC).**Structured Programming: Algorithm:** Features of good algorithm, Benefits and drawbacks of algorithm. **Flowcharts:** Advantages and limitations of flowcharts, when to use flowcharts, flowchart symbols and types of flowcharts.**Pseudocode:** Writing a pseudocode. Coding, documenting and testing a program: Comment lines and types of errors. **Program design:** Modular Programming. | **6** |
| III | **Selection Structures:** Relational and Logical Operators - Selecting from Several Alternatives – Applications of Selection Structures. **Repetition Structures:** Counter Controlled Loops –Nested Loops– Applications of Repetition Structures. | **6** |
| IV | **Data:** Numeric Data and Character Based Data. **Arrays:** One Dimensional Array - Two Dimensional Arrays – Strings as Arrays of Characters. | **6** |
| V | **Data Flow Diagrams:** Definition, DFD symbols and types of DFDs. **Program Modules:** Subprograms-Value and Reference parameters- Scope of a variable - Functions – Recursion. **Files:** File Basics-Creating and reading a sequential file- Modifying Sequential Files. | **6** |
| | **TOTAL HOURS** | **30** |

| **Course Outcomes** | | **Programme Outcomes** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Study the basic knowledge of Computers.<br>Analyze the programming languages. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO2 | Study the data types and arithmetic operations.<br>Know about the algorithms.<br>Develop program using flow chart and pseudocode. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO3 | Determine the various operators.<br>Explain about the structures.<br>Illustrate the concept of Loops | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO4 | Study about Numeric data and character-based data.<br>Analyze about Arrays. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO5 | Explain about DFD<br>Illustrate program modules.<br>Creating and reading Files | PO1, PO2, PO3, PO4, PO5, PO6 |

**Textbooks**

| | |
|---|---|
| 1 | **Stewart Venit,** "Introduction to Programming: Concepts and Design", Fourth Edition, 2010, Dream Tech Publishers. |
| **Web Resources** | |
| 1. | https://www.codesansar.com/computer-basics/problem-solving-using-computer.htm |
| 2. | http://www.nptel.iitm.ac.in/video.php?subjectId=106102067 |
| 3. | http://utubersity.com/?page_id=876 |

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

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

## Semester II

| Title of the Course/ Paper | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| **CC3** | **DATA STRUCTURES AND ALGORITHMS** | Core | 5 | - | - | - | 5 | 5 | 25 | 75 | 100 |
| **Learning Objectives** | | | | | | | | | | | |
| LO1 | To understand the concepts of ADTs | | | | | | | | | | |
| LO2 | To learn linear data structures-lists, stacks, queues | | | | | | | | | | |
| LO3 | To learn Tree structures and application of trees | | | | | | | | | | |
| LO4 | To learn graph strutures and and application of graphs | | | | | | | | | | |

| | | |
|---|---|---|
| LO5 | To understand various sorting and searching | |
| **UNIT** | **Contents** | **No. of Hours** |
| I | Abstract Data Types (ADTs)- List ADT-array-based implementation-linked list implementationsingly linked lists-circular linked lists-doubly-linked lists-applications of lists-Polynomial Manipulation- All operations-Insertion-Deletion-Merge-Traversal | 15 |
| II | Stack ADT-Operations- Applications- Evaluating arithmetic expressions – Conversion of infix topostfix expression-Queue ADT-Operations-Circular Queue- Priority Queue- deQueueapplications of queues. | 15 |
| III | Tree ADT-tree traversals-Binary Tree ADT-expression trees-applications of trees-binary search tree ADT- Threaded Binary Trees-AVL Trees- B-Tree- B+ Tree – Heap-Applications of heap. | 15 |
| IV | Definition- Representation of Graph- Types of graph-Breadth first traversal – Depth first traversal-Topological sort- Bi-connectivity – Cut vertex- Euler circuits-Applications of graphs. | 15 |
| V | Searching- Linear search-Binary search-Sorting-Bubble sort-Selection sort-Insertion sort-Shell sort-Radix sort-Hashing-Hash functions-Separate chaining- Open Addressing-RehashingExtendible Hashing | 15 |
| | **Total** | **75** |

| **Course Outcomes** | | **Programmeme Outcome** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Understand the concept of Dynamic memory management, data types, algorithms, Big O notation | PO1,PO6 |
| CO2 | Understand basic data structures such as arrays, linked lists, stacks and queues | PO2 |
| CO3 | Describe the hash function and concepts of collision and its resolution methods | PO2,PO4 |
| CO4 | Solve problem involving graphs, trees and heaps | PO4,PO6 |
| CO5 | Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data | PO5,PO6 |

| **Text Book** | |
|---|---|
| 1 | 1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Pearson Education 2014, 4th Edition. |
| 2 | ReemaThareja, “Data Structures Using C”, Oxford Universities Press 2014, 2nd Edition |
| **Reference Books** | |
| 1. | Thomas H.Cormen,ChalesE.Leiserson,RonaldL.Rivest, Clifford Stein, “Introduction to Algorithms”, McGraw Hill 2009, 3rd Edition. |
| 2. | Aho, Hopcroft and Ullman, “Data Structures and Algorithms”, Pearson Education 2003 |
| **Web Resources** | |
| 1. | https://www.programiz.com/dsa |
| 2. | https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/ |

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

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

| Title of the Course/ Paper | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| **CC4** | **DATA STRUCTURES AND ALGORITHMS LAB** [Note: Practicals may be offered through C / C++ / Python] | Core | - | - | 5 | - | 5 | 5 | 25 | 75 | 100 |
| **Learning Objectives** | | | | | | | | | | | |
| LO1 | To understand the concepts of ADTs | | | | | | | | | | |
| LO2 | To learn linear data structures-lists, stacks, queues | | | | | | | | | | |
| LO3 | To learn Tree structures and application of trees | | | | | | | | | | |
| LO4 | To learn graph strutures and and application of graphs | | | | | | | | | | |
| LO5 | To understand various sorting and searching | | | | | | | | | | |
| **Sl. No** | **Contents** | | | | | | | | | | **No. of Hours** |
| 1. | Write a program to implement the List ADT using arrays and linked lists. | | | | | | | | | | |

| | | |
|---|---|---|
| 2. | Write a programs to implement the following using a singly linked list.<br>• Stack ADT<br>• Queue ADT | **75** |
| 3. | Write a program that reads an infix expression, converts the expression to postfix form and then evaluates the postfix expression (use stack ADT). | |
| 4. | Write a program to implement priority queue ADT. | |
| 5. | Write a program to perform the following operations:<br>• Insert an element into a binary search tree.<br>• Delete an element from a binary search tree.<br>• Search for a key element in a binary search tree. | |
| 6. | Write a program to perform the following operations<br>• Insertion into an AVL-tree<br>• Deletion from an AVL-tree | |
| 7. | Write a programs for the implementation of BFS and DFS for a given graph. | |
| 8 | Write a programs for implementing the following searching methods:<br>• Linear search<br>• Binary search. | |
| 9. | Write a programs for implementing the following sorting methods:<br>• Bubble sort<br>• Selection sort<br>• Insertion sort<br>• Radix sort. | |
| | **Total** | **75** |

| **Course Outcomes** | | **Programmem Outcome** |
|---|---|---|
| CO | On completion of this course, students will | |
| 1 | Understand the concept of Dynamic memory management, data types, algorithms, Big O notation | PO1,PO4,PO5 |
| 2 | Understand basic data structures such as arrays, linked lists, stacks and queues | PO1, PO4,PO6 |
| 3 | Describe the hash function and concepts of collision and | PO1,PO3,PO6 |

| | | |
|---|---|---|
| | its resolution methods | |
| 4 | Solve problem involving graphs, trees and heaps | PO3,PO4 |
| 5 | Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data | PO1,PO5,PO6 |
| **Text Book** | | |
| 1 | Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education 2014, 4th Edition. | |
| 2 | ReemaThareja, "Data Structures Using C", Oxford Universities Press 2014, 2nd Edition | |
| **Reference Books** | | |
| 1 | Thomas H.Cormen,ChalesE.Leiserson,RonaldL.Rivest, Clifford Stein, "Introduction to Algorithms", McGraw Hill 2009, 3rd Edition | |
| 2. | Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education 2003 | |
| **Web Resources** | | |
| 1. | https://www.programiz.com/dsa | |
| 2. | https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/ | |

**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 | 1 | 3 | 2 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 2 | 3 |
| **CO 4** | 3 | 3 | 3 | 3 | 2 | 3 |
| **CO 5** | 3 | 2 | 3 | 3 | 3 | 3 |
| **Weightage of course contributed to each PSO** | 15 | 15 | 13 | 15 | 13 | 15 |

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

## SECOND YEAR

## SEMESTER III

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CIA | External | Total |
| **CC5** | Python programming | **Core** | 5 | - | - | - | 5 | 25 | 75 | 100 |
| **Learning Objectives** | | | | | | | | | | |
| **LO1** | To make students 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** | To make the students learn best practices in PYTHON programming | |
| **LO5** | To know the costs and profit maximization | |
| **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 HOURS** | **75** |

| **Course Outcomes** | | **Programme Outcomes** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Learn the basics of python, Do simple programs on python, Learn how to use an array. | PO1, PO2, PO3, |

| | | |
|---|---|---|
| | | PO4, PO5, PO6 |
| CO2 | Develop program using selection statement, Work with Looping and jump statements, Do programs on Loops and jump statements. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO3 | Concept of function, function arguments, Implementing the concept strings in various application, Significance of Modules, Work with functions, Strings and modules. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO4 | Work with List, tuples and dictionary, Write program using list, tuples and dictionary. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO5 | Usage of File handlings in python, Concept of reading and writing files, Do programs using files. | PO1, PO2, PO3, PO4, PO5, PO6 |

**Textbooks**

| | |
|---|---|
| 1 | ReemaThareja, "Python Programming using problem solving approach", First Edition, 2017, Oxford University Press. |
| 2 | Dr. R. NageswaraRao, "Core Python Programming", First Edition, 2017, Dream tech Publishers. |

**Reference Books**

| | |
|---|---|
| 1. | VamsiKurama, "Python Programming: A Modern Approach", Pearson Education. |
| 2. | Mark Lutz, "Learning Python", Orielly. |
| 3. | Adam Stewarts, "Python Programming", Online. |
| 4. | Fabio Nelli, "Python Data Analytics", APress. |
| 5. | Kenneth A. Lambert, "Fundamentals of Python – First Programs", CENGAGE Publication. |

**Web Resources**

| | |
|---|---|
| 1. | https://www.programiz.com/python-programming |
| 2. | https://www.guru99.com/python-tutorials.html |
| 3. | https://www.w3schools.com/python/python_intro.asp |
| 4. | https://www.geeksforgeeks.org/python-programming-language/ |
| 5. | https://en.wikipedia.org/wiki/Python_(programming_language) |

**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 | 2 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 2 | 2 |
| **CO 4** | 3 | 3 | 3 | 3 | 2 | 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **CO 5** | 3 | 2 | 3 | 3 | 3 | 3 |
| **Weightage of course contributed to each PSO** | 15 | 14 | 15 | 15 | 13 | 14 |

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

| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Marks** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | **CIA** | **External** | **Total** |
| CC6 | **Python Programming Lab** | **Core** | - | - | 5 | - | 5 | 25 | 75 | 100 |

**Learning Objectives**

| | |
|---|---|
| **LO1** | Be able to design and program Python applications. |
| LO2 | Be able to create loops and decision statements in Python. |
| LO3 | Be able to work with functions and pass arguments in Python. |
| LO4 | Be able to build and package Python modules for reusability. |
| LO5 | Be able to read and write files in Python. |

| **LAB EXERCISES** | **Required Hours** |
|---|---|
| 1. Program using variables, constants, I/O statements in Python.<br>2. Program using Operators in Python.<br>3. Program using Conditional Statements.<br>4. Program using Loops.<br>5. Program using Jump Statements.<br>6. Program using Functions.<br>7. Program using Recursion.<br>8. Program using Arrays.<br>9. Program using Strings.<br>10. Program using Modules.<br>11. Program using Lists.<br>12. Program using Tuples.<br>13. Program using Dictionaries.<br>14. Program for File Handling. | **75** |

**Course Outcomes**

On completion of this course, students will

| | |
|---|---|
| CO1 | Demonstrate the understanding of syntax and semantics of PYTHON language |
| CO2 | Identify the problem and solve using PYTHON programming techniques. |
| CO3 | Identify suitable programming constructs for problem solving. |
| CO4 | Analyze various concepts of PYTHON language to solve the problem in an efficient way. |
| CO5 | Develop a PYTHON program for a given problem and test for its correctness. |

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

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

## SEMESTER IV

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | Ext | Total |
| **CC7** | **Java Programming** | Core | 5 | - | - | - | 5 | 5 | 25 | 75 | 100 |

| **Learning Objectives** | |
|---|---|
| LO1 | To provide fundamental knowledge of object-oriented programming |
| LO2 | To equip the student with programming knowledge in Core Java from the basics up. |
| LO3 | To enable the students to use AWT controls, Event Handling and Swing for GUI. |
| LO4 | To provide fundamental knowledge of object-oriented programming. |

| | | |
|---|---|---|
| LO5 | To equip the student with programming knowledge in Core Java from the basics up. | |
| **UNIT** | **Contents** | **No. of Hours** |
| I | **Introduction:**ReviewofObjectOrientedconcepts - HistoryofJava - Javabuzzwords - JVMarchitecture - Datatypes - Variables - Scope and life timeofvariables - arrays - operators - controlstatements - type conversion and casting - simple java program - constructors - methods - Static block - Static Data - StaticMethodStringandStringBufferClasses. | 15 |
| II | **Inheritance**: Basic concepts - Types of inheritance - Member access rules - Usage of this and Super key word - Method Overloading - Method overriding - Abstract classes - Dynamic method dispatch - Usage of final keyword.<br>**Packages**:Definition-AccessProtection - ImportingPackages.<br>**Interfaces**:Definition–Implementation–Extending Interfaces.<br>**Exception Handling**: *try – catch- throw - throws – finally* – Built-inexceptions - Creating own Exception classes. | 15 |
| III | **Multithreaded Programming**: Thread Class - Runnable interface –Synchronization–Using synchronizedmethods– Using synchronized statement-InterthreadCommunication –Deadlock.<br>**I/O Streams:** Concepts of streams - Stream classes- Byte and Character stream - Reading console Input and Writing Console output - File Handling. | 15 |
| IV | **AWT Controls:** The AWT class hierarchy - user interface components- Labels - Button - Text Components - Check Box - Check Box Group - Choice - List Box - Panels – Scroll Pane - Menu - Scroll Bar. Working with Frame class - Colour - Fonts and layout managers.<br>**Event Handling:** Events - Event sources - Event | 15 |

| | | |
|---|---|---|
| | Listeners - Event Delegation Model (EDM) - Handling Mouse and Keyboard Events - Adapter classes - Inner classes | |
| V | **Swing:** Introduction to Swing - Hierarchy of swing components. Containers - Top level containers - JFrame - JWindow - JDialog - JPanel - JButton - JToggleButton - JCheckBox - JRadioButton - JLabel,JTextField - JTextArea - JList - JComboBox - JScrollPane. | 15 |
| | **Total** | **75** |
| **Course Outcomes** | | |
| **Course Outcomes** | On completion of this course, students will; | |
| **CO1** | Understand the basic Object-oriented concepts.Implement the basic constructs of Core Java. | PO1, PO2, PO6 |
| **CO2** | Implement inheritance, packages, interfaces and exception handling of Core Java. | PO2, PO3, PO8 |
| **CO3** | Implement multi-threading and I/O Streams of Core Java | PO1, PO3, PO5 |
| **CO4** | Implement AWT and Event handling. | PO2, PO6 |
| **CO5** | Use Swing to create GUI. | PO1, PO3, PO6 |
| **Text Books:** | | |
| 1. | Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010 | |
| 2. | Gary Cornell, *Core Java 2 Volume I – Fundamentals*, Addison Wesley, 1999 | |
| **References :** | | |
| 1. | Head First Java, O'Rielly Publications, | |
| 2. | Y. Daniel Liang, *Introduction to Java Programming*, 7th Edition, Pearson Education India, 2010 | |
| **Web Resources** | | |
| 1. | https://javabeginnerstutorial.com/core-java-tutorial | |

| | |
|---|---|
| 2. | http://docs.oracle.com/javase/tutorial/ |
| 3. | https://www.coursera.org/ |

**Mapping with Programme Outcomes:**

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

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

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| **CC8** | **Java Programming Lab** | Core | - | - | 5 | - | 5 | 5 | 25 | 75 | 100 |

| **Learning Objectives** | |
|---|---|
| LO1 | To provide fundamental knowledge of object-oriented programming. |
| LO2 | To equip the student with programming knowledge in Core Java from the basics up. |
| LO3 | To enable the students to know about Event Handling . |
| LO4 | To enable the students to use String Concepts. |
| LO5 | To equip the student with programming knowledge in to creat GUI using AWT |

| | |
|---|---|
| | controls. |
| **EXCERCISE** | **Details** |
| 1 | Write a Java program that prompts the user for an integer and then prints out all the prime numbers up to that Integer |
| 2 | Write a Java program to multiply two given matrices. |
| 3 | Write a Java program that displays the number of characters, lines and words in a text |
| 4 | Generate random numbers between two given limits using Random class and print messages according to the range of the value generated. |
| 5 | Write a program to do String Manipulation using CharacterArray and perform the following string operations:<br>a. String length<br>b. Finding a character at a particular position<br>c. Concatenating two strings |
| 6 | Write a program to perform the following string operations using String class:<br>a. String Concatenation<br>b. Search a substring<br>c. To extract substring from given string |
| 7 | Write a program to perform string operations using String Buffer class:<br>a. Length of a string<br>b. Reverse a string<br>c. Delete a substring from the given string |
| 8 | Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number. |

| | | |
|---|---|---|
| 9 | Write a threading program which uses the same method asynchronously to print the numbers 1to10 using Thread1 and to print 90 to100 using Thread2. | 75 |
| 10 | Write a program to demonstrate the use of following exceptions.<br>a. Arithmetic Exception<br>b. Number Format Exception<br>c. ArrayIndexOutofBoundException<br>d. NegativeArraySizeException | |
| 11 | Write a Java program that reads on file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes | |
| 12 | Write a program to accept a text and change its size and font. Include bold italic options. Use frames and controls. | |
| 13 | Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired. (Use adapter classes). | |
| 14 | Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero. | |
| 15 | Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with “stop” or “ready” or “go” should appear above the buttons in a selected color. Initially there is no message shown. | |
| | **Total** | **75** |

| Course Outcomes | | Programme Outcome |
|---|---|---|
| CO | On completion of this course, students will | |
| 1 | Understand the basic Object-oriented concepts.Implement the basic constructs of Core Java. | PO1 |
| 2 | Implement inheritance, packages, interfaces and exception handling of Core Java. | PO1, PO2 |
| 3 | Implement multi-threading and I/O Streams of Core Java | PO4, PO6 |
| 4 | Implement AWT and Event handling. | PO4, PO5, PO6 |
| 5 | Use Swing to create GUI. | PO3, PO6 |
| **Text Book** | | |
| 1 | Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010. | |
| 2. | Gary Cornell, *Core Java 2 Volume I – Fundamentals*, Addison Wesley, 1999. | |
| **Reference Books** | | |
| 1. | Head First Java, O'Rielly Publications, | |
| 2. | Y. Daniel Liang, *Introduction to Java Programming*, 7th Edition, Pearson Education India, 2010. | |
| **Web Resources** | | |
| 1. | https://www.w3schools.com/java/ | |
| 2. | http://java.sun.com | |
| 3. | http://www.afu.com/javafaq.html | |

**Mapping with Programme Outcomes:**

| CO/ PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | **3** | **3** | **3** | **2** |
| **CO2** | **3** | **3** | **3** | **2** | **2** | **3** |
| **CO3** | **2** | **2** | **1** | **3** | **3** | **3** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **CO4** | **3** | **3** | **3** | **3** | **3** | **2** |
| **CO5** | **3** | **3** | **3** | **3** | **3** | **2** |
| **Weightage of course contributed to each PSO** | **14** | **14** | **13** | **14** | **14** | **12** |

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

**THIRD YEAR**

**SEMESTER V**

| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | **CIA** | **External** | **Total** |
| **CC9** | **Software Engineering** | Core | 5 | - | - | - | 4 | 5 | 25 | 75 | 100 |

| **Learning Objectives** | |
|---|---|
| LO1 | Gain basic knowledge of analysis and design of systems |
| LO2 | Ability to apply software engineering principles and techniques |
| LO3 | Model a reliable and cost-effective software system |
| LO4 | Ability to design an effective model of the system |
| LO5 | Perform Testing at various levels and produce an efficient system. |

| **UNIT** | **Contents** | **No. of Hours** | **Course Objectives** |
|---|---|---|---|
| I | **Introduction**: The software engineering discipline, programs vs. software products, why study software engineering, emergence of software engineering, Notable changes in software development practices, computer systems engineering.<br><br>**Software Life Cycle Models**: Why use a life cycle model, Classical waterfall model, iterative waterfall | 15 | |

| | | |
|---|---|---|
| | model, prototyping model, evolutionary model, spiral model, comparison of different life cycle models. | |
| II | **Requirements Analysis and Specification:** Requirements gathering and analysis, Software requirements specification (SRS)<br><br>**Software Design**: Good software design, cohesion and coupling, neat arrangement, software design approaches, object- oriented vs function-oriented design | 15 |
| III | **Function-Oriented Software Design:** Overview of SA/SD methodology, structured analysis, data flow diagrams (DFD's), structured design, detailed design.**User-Interface design:** Characteristics of a good interface; basic concepts; types of user interfaces; component based GUI development, a user interface methodology. | 15 |
| IV | **Coding and Testing:** Coding; code review; testing; testing in the large vs testing in the small; unit testing; black-box testing; white-box testing; debugging; program analysis tools; integration testing; system testing; some general issues associated with testing.**Software Reliability and Quality Management:** Software reliability; statistical testing; software quality; software quality management system; SEI capability maturity model; personal software process. | 15 |
| V | **Computer Aided Software Engineering:** CASE and its scope; CASE environment; CASE support in software life cycle; other characteristics of CASE tools; towards second generation CASE tool; architecture of a CASE environment. **Software Maintenance:** Characteristic of | 15 |

| | | |
|---|---|---|
| | software maintenance; software reverse engineering; software maintenance process models; estimation of maintenance cost. | |
| | **Total** | **75** |
| **Course Outcomes** | | |
| **Course Outcomes** | On completion of this course, students will; | |
| **CO1** | Gain basic knowledge of analysis and design of systems | PO1 |
| **CO2** | Ability to apply software engineering principles and techniques | PO1, PO2 |
| **CO3** | Model a reliable and cost-effective software system | PO4, PO6 |
| **CO4** | Ability to design an effective model of the system | PO4, PO5, PO6 |
| **CO5** | Perform Testing at various levels and produce an efficient system. | PO3, PO6 |
| **Text Books** | | |
| 1. | Rajib Mall, Fundamentals of Software Engineering, Fifth Edition, Prentice-Hall of India, 2018 | |
| **References Books** | | |
| 1. | Richard Fairley, Software Engineering Concepts, Tata McGraw-Hill publishing company Ltd, Edition 1997 | |
| 2. | Roger S. Pressman, Software Engineering, Seventh Edition, McGraw-Hill. | |
| 3. | James A. Senn, Analysis & Design of Information Systems, Second Edition, McGraw-Hill International Editions. | |

**Mapping with Programme Outcomes:**

| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 2 | 2 | 3 |
| CO2 | 3 | 2 | 2 | 2 | 1 | 2 |
| CO3 | 3 | 3 | 3 | 2 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 2 | 2 | 2 |
| Weightage of course contribute d to each PO/PSO | 15 | 13 | 14 | 10 | 10 | 11 |

**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 |
| CC10 | Database Management System | Core | 5 | - | - | - | 4 | 5 | 25 | 75 | 100 |
| Learning Objectives | | | | | | | | | | | |
| LO1 | To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms. | | | | | | | | | | |
| LO2 | To understood the concepts of data base management system, design simple Database models | | | | | | | | | | |
| LO3 | To learn and understand to write queries using SQL, PL/SQL. | | | | | | | | | | |
| LO4 | To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms. | | | | | | | | | | |
| LO5 | To understood the concepts of data base management system, design simple Database models | | | | | | | | | | |
| UNIT | Contents | | | | | | | No. of Hours | | | |

| | | |
|---|---|---|
| I | **Database Concepts:**Database Systems - Data vs Information - Introducing the database -File system - Problems with file system – Database systems. Data models - Importance - Basic Building Blocks - Business rules - Evolution of Data models - Degrees of Data Abstraction | 15 |
| II | **Design Concepts:** Relational database model - logical view of data-keys -Integrity rules - relational set operators - data dictionary and the system catalog - relationships -data redundancy revisited -indexes - codd's rules. Entity relationship model - ER diagram | 15 |
| III | **Normalization of Database Tables**: Database tables and Normalization – The Need for Normalization –The Normalization Process – Higher level Normal Form.<br><br>**Introduction to SQL**: Data Definition Commands – Data Manipulation Commands – SELECT Queries – Additional Data Definition Commands – Additional SELECT Query Keywords – Joining Database Tables. | 15 |
| IV | **Advanced SQL**:Relational SET Operators: UNION – UNION ALL – INTERSECT - MINUS.SQL Join Operators: Cross Join – Natural Join – Join USING Clause – JOIN ON Clause – Outer Join.**Sub Queries and Correlated Queries**: WHERE – IN – HAVING – ANY and ALL – FROM. SQL Functions: Date and Time Function – Numeric Function – String Function – Conversion Function | 15 |
| V | **PL/SQL**:A Programming Language: History – Fundamentals – Block Structure – Comments – Data Types – Other Data Types – Variable Declaration – | 15 |

| | | |
|---|---|---|
| | Assignment operation –Arithmetic operators.**Control Structures and Embedded SQL**: Control Structures – Nested Blocks – SQL in PL/SQL – Data Manipulation – Transaction Control statements. **PL/SQL Cursors and Exceptions**: Cursors – Implicit Cursors, Explicit Cursors and Attributes – Cursor FOR loops – SELECT…FOR UPDATE – WHERE CURRENT OF clause – Cursor with Parameters – Cursor Variables – Exceptions – Types of Exceptions. | |
| | **Total** | **75** |

| **Course Outcomes** | | **Programme Outcomes** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Understand the various basic concepts of Data Base System. Difference between file system and DBMS and compare various data models. | PO1 |
| CO2 | Define the integrity constraints. Understand the basic concepts of Relational Data Model, Entity-Relationship Model. | PO1, PO2 |
| CO3 | Design database schema considering normalization and relationships within database. Understand and construct database using Structured Query Language. Attain a good practical skill of managing and retrieving of data using Data Manipulation Language (DML) | PO4, PO6 |
| CO4 | Classify the different functions and various join operations and enhance the knowledge of handling multiple tables. | PO4, PO5, PO6 |
| CO5 | Learn to design Data base operations and implement using PL/SQL programs. Learn basics of PL/SQL and develop programs using Cursors, Exceptions | PO3, PO5 |

| **Text Book** | |
|---|---|
| 1 | Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition |
| 2 | Nilesh Shah, "Database Systems Using Oracle", 2nd edition, Pearson Education India, 2016 |

| Reference Books | |
|---|---|
| 1. | Abraham Silberschatz, Henry F.Korth and S.Sudarshan,"Database System Concepts", McGraw Hill International Publication ,VI Edition |
| 2. | Shio Kumar Singh , "Database Systems ",Pearson publications ,II Edition |
| **Web Resources** | |
| 1. | Web resources from NDL Library, E-content from open-source libraries |

**Mapping with Programme Outcomes:**

| CO/ PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **1** | **2** | **1** | **2** |
| **CO2** | **3** | **3** | **2** | **2** | **3** | **3** |
| **CO3** | **3** | **3** | **2** | **3** | **3** | **2** |
| **CO4** | **3** | **2** | **3** | **2** | **2** | **3** |
| **CO5** | **3** | **2** | **2** | **2** | **3** | **3** |
| **Weightage of course contributed to each PSO** | **15** | **12** | **10** | **11** | **12** | **13** |

**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 |
| **CC11** | **Database Management System lab** | Core | - | - | 5 | - | 4 | 5 | 25 | 75 | 100 |
| **Learning Objectives** | | | | | | | | | | | |
| LO1 | To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms. | | | | | | | | | | |
| LO2 | To understood the concepts of data base management system, design simple Database models | | | | | | | | | | |

| | | | |
|---|---|---|---|
| LO3 | To learn and understand to write queries using SQL, PL/SQL. | | |
| LO4 | To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms. | | |
| LO5 | To understood the concepts of data base management system, design simple Database models | | |
| | **List of Exercises:** | **No. of Hours** | **Course Objective** |
| II | ***I. SQL***<br>1. DDLCOMMANDS<br>2. DMLCOMMANDS<br>3. TCLCOMMANDS<br>***II. PL/SQL***<br>4. FIBONACCI SERIES<br>5. FACTORIAL<br>6. STRING REVERSE<br>7. SUM OF SERIES<br>8. TRIGGER<br>***III. CURSOR***<br>9. STUDENT MARK ANALYSIS USING CURSOR<br>***IV. APPLICATION***<br>10. LIBRARY MANAGEMENTSYSTEM<br>11. STUDENT MARK ANALYSIS | | 75 |
| | **Total** | | **75** |

| **Course Outcomes** | | **Programme Outcomes** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Understand the various basic concepts of Data Base System. Difference between file system and DBMS and compare various data models. | PO1 |

| | | |
|---|---|---|
| CO2 | Define the integrity constraints. Understand the basic concepts of Relational Data Model, Entity-Relationship Model. | PO1, PO2 |
| CO3 | Design database schema considering normalization and relationships within database. Understand and construct database using Structured Query Language. Attain a good practical skill of managing and retrieving of data using Data Manipulation Language (DML) | PO4, PO6 |
| CO4 | Classify the different functions and various join operations and enhance the knowledge of handling multiple tables. | PO4, PO5, PO6 |
| CO5 | Learn to design Data base operations and implement using PL/SQL programs. Learn basics of PL/SQL and develop programs using Cursors, Exceptions | PO3, PO4 |
| **Text Book** | | |
| 1 | Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition | |
| 2 | Nilesh Shah, "Database Systems Using Oracle", 2nd edition, Pearson Education India, 2016 | |
| **Reference Books** | | |
| 1. | Abraham Silberschatz, Henry F.Korth and S.Sudarshan,"Database System Concepts", McGraw Hill International Publication ,VI Edition | |
| 2. | Shio Kumar Singh , "Database Systems ",Pearson publications ,II Edition | |
| **Web Resources** | | |
| 1. | Web resources from NDL Library, E-content from open-source libraries | |

**Mapping with Programme Outcomes:**

| CO/ PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **3** | **3** | **3** | **2** |
| **CO2** | **3** | **3** | **1** | **2** | **2** | **2** |
| **CO3** | **2** | **2** | **3** | **3** | **3** | **3** |
| **CO4** | **2** | **2** | **3** | **3** | **3** | **1** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **CO5** | **2** | **3** | **3** | **3** | **3** | **3** |
| **Weightage of course contributedto each PSO** | **12** | **12** | **13** | **14** | **14** | **11** |

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

## SEMESTER VI

| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | **CIA** | **External** | **Total** |
| **CC13** | **Computer Networks** | Core | 6 | - | - | - | 4 | 6 | 25 | 75 | 100 |

| **Course Objective** | |
|---|---|
| LO1 | To learn the basic concepts of Data communication and Computer network |
| LO2 | To learn about wireless Transmission |
| LO3 | To learn about networking and data link layer. |
| LO4 | To study about Network communication. |
| LO5 | To learn the concept of Transport layer |

| **UNIT** | **Contents** | **No. of Hours** |
|---|---|---|
| I | Introduction – Network Hardware – Software – Reference Models – OSI and TCP/IP Models – Example Networks: Internet, ATM, Ethernet and Wireless LANs - Physical Layer – Theoretical Basis for Data Communication - Guided Transmission Media | 18 |
| II | Wireless Transmission - Communication Satellites – Telephone System: Structure, Local Loop, Trunks and Multiplexing and Switching. Data Link Layer: Design Issues – Error Detection and Correction. | 18 |
| III | Elementary Data Link Protocols - Sliding Window Protocols – Data Link Layer in the Internet - Medium Access Layer – Channel Allocation Problem – Multiple Access Protocols – Bluetooth. | 18 |
| IV | Network Layer - Design Issues - Routing Algorithms - Congestion Control Algorithms – IP Protocol – IP Addresses – Internet Control Protocols. | 18 |
| V | Transport Layer - Services - Connection Management - Addressing, | 18 |

| | | |
|---|---|---|
| | Establishing and Releasing a Connection – Simple Transport Protocol – Internet Transporet Protocols (ITP) - Network Security: Cryptography | |
| | **Total** | **90** |

| **Course Outcomes** | | **Programme Outcome** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | To Understand the basics of Computer Network architecture, OSI and TCP/IP reference models | PO1 |
| CO2 | To gain knowledge on Telephone systems using wireless network | PO1, PO2 |
| CO3 | To understand the concept of MAC | PO4, PO6 |
| CO4 | To analyze the characteristics of Routing and Congestion control algorithms | PO4, PO5, PO6 |
| CO5 | To understand network security and define various protocols such as FTP, HTTP, Telnet, DNS | PO3, PO4 |

| **Text Book** | |
|---|---|
| 1 | A. S. Tanenbaum, "Computer Networks", 4th Edition, Prentice-Hall of India, 2008. |
| **Reference Books** | |
| 1. | B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th Edition, 2017 |
| 2. | F. Halsall, "Data Communications, Computer Networks and Open Systems", Pearson Education, 2008 |
| 3. | D. Bertsekas and R. Gallagher, "Data Networks", 2nd Edition, PHI, 2008. |
| 4. | Lamarca, "Communication Networks", Tata McGraw- Hill, 2002 |
| **Web Resources** | |
| 1. | https://en.wikipedia.org/wiki/Computer_network |
| 2. | https://citationsy.com/styles/computer-networks |

**Mapping with Programme Outcomes:**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | **2** | **3** | **2** | **3** |
| **CO2** | **3** | **2** | **2** | **2** | **2** | **2** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **CO3** | **3** | **2** | **3** | **3** | **2** | **3** |
| **CO4** | **3** | **2** | **2** | **2** | **2** | **2** |
| **CO5** | **3** | **2** | **2** | **2** | **2** | **3** |
| **Weightage of course contributed to each PSO** | **15** | **11** | **11** | **12** | **10** | **13** |

**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** |
| **CC14** | **.Net Programming** | Core | 6 | - | - | - | 4 | 6 | 25 | 75 | 100 |

| **Course Objective** | |
|---|---|
| C1 | To identify and understand the goals and objectives of the .NET framework and ASP.NET with C# language. |
| C2 | To develop ASP.NET Web application using standardcontrols. |
| C3 | To implement file handling operations. |
| C4 | To handles SQL Server Database using ADO.NET. |
| C5 | Understand the Grid view control and XML classes. |

| **UNIT** | **Contents** | **No. of Hours** |
|---|---|---|
| I | Overview of .NET framework: Common Language Runtime (CLR), Framework Class Library- C# Fundamentals: Primitive types and Variables – Operators - Conditional statements -Looping statements – Creating and using Objects – Arrays – Stringoperations. | 18 |
| II | Introduction to ASP.NET - IDE-Languages supported Components -Working with Web Forms – Web form standard controls: Properties and its events – HTML controls -List Controls: Properties and its events. | 18 |

| | | |
|---|---|---|
| III | Rich Controls: Properties and its events – validation controls: Properties and its events– File Stream classes - File Modes – File Share – Reading and Writing to files – Creating, Moving, Copying and Deletingfiles – File uploading. | 18 |
| IV | ADO.NET Overview – Database Connections – Commands – Data Reader - Data Adapter - Data Sets - Data Controlsand its Properties – DataBinding | 18 |
| V | Grid View control: Deleting, editing, Sorting and Paging. XML classes – Web form to manipulate XML files - Website Security - Authentication - Authorization – Creating aWeb application. | 18 |
| | **Total** | **90** |

| **Course Outcomes** | | **Programme Outcome** |
|---|---|---|
| CO | On completion of this course, students will | |
| 1 | Develop working knowledge of C# programming constructs and the .NET Framework | PO1, PO2, PO6 |
| 2 | To develop a software to solve real-world problems using ASP.NET | PO2, PO3, PO5 |
| 3 | To Work On Various Controls Files | PO1, PO3, PO6 |
| 4 | To create a web application using MicrosoftADO.NET. | PO2, PO6 |
| 5 | To develop web applications using XML | PO1, PO3, PO6 |

**Text Book**

| | |
|---|---|
| 1 | SvetlinNakov,VeselinKolev& Co, Fundamentals of Computer Programming with C#,Faber publication,2019. |
| 2 | Mathew, Mac Donald, The Complete Reference ASP.NET, Tata McGraw-Hill,2015. |

**Reference Books**

| | |
|---|---|
| 1. | Herbert Schildt, The Complete Reference C#.NET, TataMcGraw-Hill,2017. |
| 2. | Kogent Learning Solutions, C# 2012 Programming Covers .NET 4.5 Black Book, |

| | |
|---|---|
| | Dreamtechpres,2013. |
| 3. | Anne Boehm, Joel Murach, Murach's C# 2015, Mike Murach& Associates Inc.2016. |
| 4. | DenielleOtey, Michael Otey, ADO.NET: The Complete reference, McGrawHill,2008. |
| 5. | Matthew MacDonald, Beginning ASP.NET 4 in C# 2010,APRESS,2010. |
| **Web Resources** | |
| 1. | https://www.geeksforgeeks.org/introduction-to-net-framework/ |
| 2. | https://www.javatpoint.com/net-framework |

**Mapping with Programme Outcomes:**

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

**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 |
| **CC15** | **.Net Programming LAB** | Core | - | - | 6 | - | 4 | 6 | 25 | 75 | 100 |
| **Course Objective** | | | | | | | | | | | |
| LO1 | To develop ASP.NET Web application using standardcontrols. | | | | | | | | | | |
| LO2 | To create rich database applications usingADO.NET. | | | | | | | | | | |
| LO3 | To implement file handling operations. | | | | | | | | | | |
| LO4 | To implement XML classes. | | | | | | | | | | |

| | | |
|---|---|---|
| LO5 | To utilize ASP.NET security features for authenticating the website | |
| **Sl. No** | **Programs** | **No. of Hours** |
| 1. | Create an exposure of Web applications and tools | 90 |
| 2. | Implement the Html Controls | |
| 3. | Implement the Server Controls | |
| 4. | Web application using Web controls. | |
| 5. | Web application using List controls. | |
| 6. | Web Page design using Rich control. Validate user input using Validation controls. Working with Fileconcepts. | |
| 7. | Web application using Data Controls. | |
| 8. | Data binding with Web controls | |
| 9. | Data binding with Data Controls. | |
| 10. | Database application to perform insert, update and delete operations. | |
| 11. | Database application using Data Controls to perform insert, delete, edit, paging and sorting operation. | |
| 12. | Implement the Xml classes. | |
| 13. | Implement Authentication – Authorization. | |
| 14. | Ticket reservation using ASP.NET controls. | |
| 15. | Online examination using ASP.NET controls | |
| | **Total** | **90** |
| **Course Outcomes** | | **Programme Outcome** |
| CO | On completion of this course, students will | |
| CO1 | To create web applications and implement various controls | PO1, PO2, PO4 |
| CO2 | Create web pages in Rich control. | PO3, PO5 |
| CO3 | Develop knowledge about file handling operations | PO1, PO4, PO5 |

| | | |
|---|---|---|
| CO4 | An ability to design XML classes | PO2, PO4, PO6 |
| CO5 | To develop a software to solve real-world problems using ASP.NET | PO1,PO3, PO5, PO6 |
| **Text Book** | | |
| 1 | SvetlinNakov, VeselinKolev& Co, Fundamentals of Computer Programming with C#, Faber publication,2019. | |
| 2 | Mathew, Mac Donald, The Complete Reference ASP.NET, Tata McGraw-Hill,2015. | |
| **Reference Books** | | |
| 1. | Herbert Schildt, The Complete Reference C#.NET, TataMcGraw-Hill,2017. | |
| 2. | Kogent Learning Solutions, C# 2012 Programming Covers .NET 4.5 Black Book, Dreamtech pres,2013. | |
| 3. | Anne Boehm, Joel Murach, Murach's C# 2015, Mike Murach& Associates Inc.2016. | |
| 4. | DenielleOtey, Michael Otey, ADO.NET: The Complete reference, McGrawHill,2008. | |
| 5. | Matthew MacDonald, Beginning ASP.NET 4 in C# 2010, APRESS,2010. | |
| **Web Resources** | | |
| 1. | https://www.geeksforgeeks.org/introduction-to-net-framework/ | |
| 2. | https://www.javatpoint.com/net-framework | |

**Mapping with Programme Outcomes:**

| CO/ PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **1** | **2** | **1** | **2** |
| **CO2** | **3** | **3** | **2** | **2** | **3** | **3** |
| **CO3** | **3** | **3** | **2** | **3** | **3** | **2** |
| **CO4** | **3** | **2** | **3** | **2** | **2** | **3** |
| **CO5** | **3** | **2** | **2** | **2** | **3** | **3** |
| **Weightage of course contributed to each PSO** | **15** | **12** | **10** | **11** | **12** | **13** |

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

# Annexure I

## Suggested topics in Core component

1. Programming in C
2. Programming in C Lab
3. Object oriented Programming using C++
4. Object oriented Programming using C++ Lab
5. Mobile Application Development
6. Mobile Application Development Lab
7. Data Analytics using R
8. Data Analytics using RLab
9. Machine Learning
10. Machine Learning Lab
11. Data Mining and Warehousing
12. Software Metrics
13. Network Security

# Suggested topics in Core component

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| **CC** | **PROGRAMMING IN C** | Core | 5 | - | - | - | 4 | 5 | 25 | 75 | 100 |
| **Learning Objective** | | | | | | | | | | | |
| LO1 | To familiarize the students with the Programming basics and the fundamentals of C, Datatypes in C, Mathematical and logical operations. | | | | | | | | | | |
| LO2 | To understand the concept using if statements and loops | | | | | | | | | | |
| LO3 | This unit covers the concept of Arrays and Functions | | | | | | | | | | |
| LO4 | This unit covers the concept of Structurs and unions and Preprocessors | | | | | | | | | | |
| LO5 | To understand the concept of implementing pointers. | | | | | | | | | | |
| **UNIT** | **Contents** | | | | | | | | **No. of Hours** | | |
| I | **Overview of C**: Importance of C, sample C program, C program structure, executing C program.<br>Constants, Variables, and Data Types: Character set, C tokens, keywords and identifiers, constants, variables, data types, declaration of variables, Assigning values to variables--- | | | | | | | | 15 | | |

| | | |
|---|---|---|
| | Assignment statement, declaring a variable as constant, as volatile.<br>**Operators and Expression**: Arithmetic, Relational, logical, assignment, increment, decrement, conditional, bitwise and special operators, arithmetic expressions, operator precedence, type conversions, mathematical functions<br>**Managing Input and Output Operators**: Reading and writing a character, formatted input, formatted output. | |
| II | **Decision Making and Branching**: Decision making with If, simple IF, IF ELSE, nested IF ELSE , ELSE IF ladder, switch, GOTO statement.<br>**Decision Making and Looping**: While, Do-While, For, Jumps in loops. | 15 |
| III | **Arrays**: Declaration and accessing of one & two-dimensional arrays, initializing two-dimensional arrays, multidimensional arrays.<br>**Functions**: The form of C functions, Return values and types, calling a function, categories of functions, Nested functions, Recursion, functions with arrays, call by value, call by reference, storage classes-character arrays and string functions. | 15 |
| IV | **Structures and Unions**: Defining, giving values to members, initialization and comparison of structure variables, arrays of structure, arrays within structures, structures within structures, structures and functions, unions.<br>**Preprocessors**: Macro substitution, file inclusion. | 15 |
| V | **Pointers:** definition, declaring and initializing pointers, accessing a variable through address and through pointer, pointer expressions, pointer increments and scale factor, pointers and arrays, pointers and functions, pointers and structures. | 15 |
| | **Total** | **75** |

| **Course Outcomes** | | **Programme Outcome** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Remember the program structure of C with its syntax and semantics | PO1,PO3,PO5 |
| CO2 | Understand the programming principles in C (data types, operators, branching and looping, arrays, | PO2,PO3,PO6 |

| | | |
|---|---|---|
| | functions, structures, pointers and files) | |
| CO3 | Apply the programming principles learnt in real-time problems | PO3,PO4,PO5 |
| CO4 | Analyze the various methods of solving a problem and choose the best method | PO4,PO5,PO6 |
| CO5 | Code, debug and test the programs with appropriate test cases | PO5,PO6 |
| **Text Book** | | |
| 1 | E. Balagurusamy, Programming in ANSI C, Fifth Edition, Tata McGraw-Hill, 2010. | |
| **Reference Books** | | |
| 1. | Byron Gottfried, Schaum's Outline Programming with C, Fourth Edition, Tata McGraw-Hill, 2018. | |
| 2. | Kernighan and Ritchie, The C Programming Language, Second Edition, Prentice Hall, 1998 | |
| 3. | YashavantKanetkar, Let Us C, Eighteenth Edition, BPB Publications,2021 | |
| **Web Resources** | | |
| 1. | https://codeforwin.org/ | |
| 2. | https://www.geeksforgeeks.org/c-programming-language/ | |
| 3. | http://en.cppreference.com/w/c | |
| 4. | http://learn-c.org/ | |
| 5. | https://www.cprogramming.com/ | |

**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 | 2 | 3 | 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **CO 3** | 2 | 3 | 2 | 3 | 3 | 2 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 5** | 3 | 3 | 3 | 3 | 3 | 2 |
| **Weight age of course contributed to each PSO** | 14 | 15 | 14 | 14 | 15 | 13 |

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** |
| **CC** | **PROGRAMMING IN C LAB** | Core | - | - | 4 | - | 4 | 4 | 25 | 75 | 100 |

| **Course Objective** | | | |
|---|---|---|---|
| LO1 | To familiarize the students with the Programming basics and the fundamentals of C, Datatypes in C, Mathematical and logical operations. | | |
| LO2 | To understand the concept using if statements and loops | | |
| LO3 | This unit covers the concept of Arrays and Functions | | |
| LO4 | This unit covers the concept of Structurs and unions and Preprocessors | | |
| LO5 | To understand the concept of implementing pointers and files | | |
| **UNIT** | **List of Excercises** | **No. of Hours** | **Course Objectives** |
| I | **Unit I : Variables, Data types, Constants and Operators**<br>1.Evaluation of expression ex: ((x+y) ^2 * (x+z))/w<br>2.Temperature conversion problem (Fahrenheit to Celsius)<br>3.Program to convert days to months and days (Ex: 364 days = 12 months and 4 days)<br>4.Solution of quadratic equation<br>5.Salesman salary (Given: Basic Salary, Bonus for every item sold, commission on the total monthly sales) | 12 | |
| II | **Unit II: Decision making Statements** | 12 | |

| | | |
|---|---|---|
| | 6.Maximum of three numbers<br>7.Calculate Square root of five numbers (using gototatement)<br>8.Pay-Bill Calculation for different levels of employee (Switch statement)<br>9. Fibonacci series<br>10.Floyds Triangle<br>11.Pascal's Triangle | |
| III | **Unit III: Arrays, Functions and Strings**<br>12.Prime numbers in an array<br>13.Sorting data (Ascending and Descending)<br>14.Matrix Addition and Subtraction<br>15.Matrix Multiplication<br>16.Function with no arguments and no return values<br>17.Function that convert lower case letters to upper case<br>18. Factorial using recursion.<br>19.Perform String Operations using Switch Case. | 12 |
| IV | **Unit IV : Structures and Macros**<br>20.Structure that describes a Hotel (name, address, grade, avg room rent, number of rooms) Perform some operations (list of hotels of a given grade etc.)<br>21. Using Pointers in Structures.<br>22.Cricket team details using Union.<br>23.Write a macro that calculates the max and min of two numbers<br>24.Nested macro to calculate Cube of a number. | 12 |

| | | |
|---|---|---|
| V | **Unit V : Pointers and Files**<br>25.Evaluation of Pointer expressions<br>26.Function to exchange two pointer values<br>27.Creation, insertion and deletion in a linked list<br>28.Program to read a file and print the data.<br>29.Program to receive a file name and a line of text as command line arguments and write the text to the file<br>30. Program to copy the content of one file to another file. | 12 |
| | **Total** | **60** |

| **Course Outcomes** | | **Programme Outcome** |
|---|---|---|
| CO | On completion of this course, students will | |
| 1 | Remember the program structure of C with its syntax and semantics | PO1,PO3,PO5 |
| 2 | Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files) | PO2,PO3,PO6 |
| 3 | Apply the programming principles learnt in real-time problems | PO3,PO4 |
| 4 | Analyze the various methods of solving a problem and choose the best method | PO4,PO5,PO6 |
| 5 | Code, debug and test the programs with appropriate test cases | PO4,PO6 |

| **Text Book** | |
|---|---|
| 1 | E. Balagurusamy, Programming in ANSI C, Fifth Edition, Tata McGraw-Hill, 2010. |

| **Reference Books** | |
|---|---|
| 1. | Byron Gottfried, Schaum's Outline Programming with C, Fourth Edition, Tata McGraw-Hill, 2018. |
| 2. | Kernighan and Ritchie, The C Programming Language, Second Edition, Prentice Hall, 1998 |

| | |
|---|---|
| 3. | YashavantKanetkar, Let Us C, Eighteenth Edition, BPB Publications,2021 |
| **Web Resources** | |
| 1. | https://codeforwin.org/ |
| 2. | https://www.geeksforgeeks.org/c-programming-language/ |
| 3. | http://en.cppreference.com/w/c |
| 4. | http://learn-c.org/ |
| 5. | https://www.cprogramming.com/ |

**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 |
| **Weight age of course contributed to each PSO** | 14 | 15 | 14 | 15 | 15 | 14 |

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 |
| **CC** | **OBJECT ORIENTED PROGRAMMING USING C++** | Core | 5 | - | - | - | 4 | 5 | 25 | 75 | 100 |
| **Learning Objective** | | | | | | | | | | | |
| LO1 | Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects | | | | | | | | | | |

| | | |
|---|---|---|
| LO2 | Understand dynamic memory management techniques using pointers, constructors, destructors, etc | |
| LO3 | Describe the concept of function overloading, operator overloading, virtual functions and polymorphism | |
| LO4 | Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming | |
| LO5 | Demonstrate the use of various OOPs concepts with the help of programs | |
| **UNIT** | **Contents** | **No. of Hours** |
| I | Introduction to C++ - key concepts of Object-Oriented Programming – Advantages – ObjectOriented Languages – I/O in C++ - C++ Declarations. Control Structures : - Decision Makingand Statements : If ..else, jump, goto, break, continue, Switch case statements - Loops in C++ :for, while, do - functions in C++ - inline functions – Function Overloading. | 15 |
| II | Classes and Objects: Declaring Objects – Defining Member Functions – Static Member variablesand functions – array of objects –friend functions – Overloading member functions – Bit fieldsand classes – Constructor and destructor with static members. | 15 |
| III | Operator Overloading: Overloading unary, binary operators – Overloading Friend functions –type conversion – Inheritance: Types of Inheritance – Single, Multilevel, Multiple, Hierarchal,Hybrid, Multi path inheritance – Virtual base Classes – Abstract Classes. | 15 |
| IV | Pointers – Declaration – Pointer to Class , Object – this pointer – Pointers to derived classes andBase classes – Arrays – Characteristics – array of classes – Memory models – new and deleteoperators – dynamic object – Binding, Polymorphism and Virtual Functions. | 15 |
| V | Files – File stream classes – file modes – Sequential Read / Write operations – Binary and ASCIIFiles – Random Access Operation – Templates – Exception Handling - String – Declaring andInitializing string objects – String Attributes – Miscellaneous functions. | 15 |
| | **Total** | **75** |

| **Course Outcomes** | | **Programme Outcome** |
|---|---|---|
| CO | Upon completion of the course the students would be able to: | |
| 1 | Remember the program structure of C with its syntax and semantics | PO1,PO6 |

| | | |
|---|---|---|
| 2 | Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files) | PO2 |
| 3 | Apply the programming principles learnt in real-time problems | PO4 ,PO5 |
| 4 | Analyze the various methods of solving a problem and choose the best method | PO6 |
| 5 | Code, debug and test the programs with appropriate test cases | PO3,PO6 |
| **Text Book** | | |
| 1 | E. Balagurusamy, "Object-Oriented Programming with C++", TMH 2013, 7th Edition. | |
| **Reference Books** | | |
| 1. | Ashok N Kamthane, "Object-Oriented Programming with ANSI and Turbo C++", Pearson Education 2003. | |
| 2. | Maria Litvin& Gray Litvin, "C++ for you", Vikas publication 2002. | |
| **Web Resources** | | |
| 1. | https://alison.com/course/introduction-to-c-plus-plus-programming | |

**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 | 2 | 3 | 3 |
| **CO 3** | 3 | 2 | 2 | 2 | 3 | 2 |
| **CO 4** | 3 | 3 | 3 | 3 | 2 | 3 |
| **CO 5** | 3 | 2 | 3 | 2 | 3 | 3 |
| **Weight age of course contributed to each PSO** | 15 | 13 | 14 | 12 | 14 | 14 |

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 |
| **CC** | **OBJECT ORIENTED PROGRAMMING USING C++LAB** | Core | - | - | 4 | - | 4 | 4 | 25 | 75 | 100 |

| **Course Objective** | |
|---|---|
| C1 | Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects |
| C2 | Understand dynamic memory management techniques using pointers, constructors, destructors, etc |
| C3 | Describe the concept of function overloading, operator overloading, virtual functions and polymorphism |
| C4 | Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming |
| C5 | Demonstrate the use of various OOPs concepts with the help of programs |

| **S.No** | **List of Excercises** | **No. of Hours** |
|---|---|---|
| 1 | Write a C++ program to demonstrate function overloading, Default Arguments and Inlinefunction. | 60 |
| 2 | Write a C++ program to demonstrate Class and Objects | |
| 3 | Write a C++ program to demonstrate the concept of Passing Objects to Functions | |
| 4 | Write a C++ program to demonstrate the Friend Functions. | |
| 5 | Write a C++ program to demonstrate the concept of Passing Objects to Functions | |
| 6 | Write a C++ program to demonstrate Constructor and Destructor | |
| 7 | Write a C++ program to demonstrate Unary Operator Overloading | |

| | | |
|---|---|---|
| 8 | Write a C++ program to demonstrate Binary Operator Overloading | |
| 9 | Write a C++ program to demonstrate:<br>• Single Inheritance<br>• Multilevel Inheritance<br>• Multiple Inheritance<br>• Hierarchical Inheritance<br>• Hybrid Inheritance | |
| 10 | Write a C++ program to demonstrate Virtual Functions. | |
| 11 | Write a C++ program to manipulate a Text File. | |
| 12 | Write a C++ program to perform Sequential I/O Operations on a file. | |
| 13 | Write a C++ program to find the Biggest Number using Command Line Arguments | |
| 14 | Write a C++ program to demonstrate Class Template | |
| 15 | Write a C++ program to demonstrate Function Template. | |
| 16 | Write a C++ program to demonstrate Exception Handling. | |

| **Course Outcomes** | | **Programme Outcome** |
|---|---|---|
| CO | Upon completion of the course the students would be able to: | |
| 1 | Remember the program structure of C with its syntax and semantics | PO4,PO5 |
| 2 | Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files) | PO6 |
| 3 | Apply the programming principles learnt in real-time problems | PO4 ,PO5 |
| 4 | Analyze the various methods of solving a problem and choose the best method | PO6 |
| 5 | Code, debug and test the programs with appropriate test cases | PO4,PO5 |

| **Text Book** | |
|---|---|
| 1 | E. Balagurusamy, “Object-Oriented Programming with C++”, TMH 2013, 7th Edition. |

| **Reference Books** |
|---|

| | |
|---|---|
| 1. | Ashok N Kamthane, “Object-Oriented Programming with ANSI and Turbo C++”, Pearson Education 2003. |
| 2. | Maria Litvin& Gray Litvin, “C++ for you”, Vikas publication 2002. |
| **Web Resources** | |
| 1. | https://alison.com/course/introduction-to-c-plus-plus-programming |

**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 | 2 | 3 | 3 | 2 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 4** | 3 | 2 | 2 | 3 | 3 | 3 |
| **CO 5** | 3 | 2 | 3 | 3 | 3 | 2 |
| **Weightage of course contributed to each PSO** | 15 | 12 | 14 | 15 | 14 | 14 |

**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 |
| **CC** | **MOBILE APPLICATION DEVELOPMENT** | **Core** | **5** | **-** | **-** | **-** | **4** | **5** | **25** | **75** | **100** |

| Course objectives | |
|---|---|
| **LO1** | To provide the students with the basics of Android Programming |
| **LO2** | To gain knowledge on Software Development tools for Mobile Applications |
| **LO3** | Development of software on mobile platform for Real Time use |

| Unit | Contents | No. of Hours |
|---|---|---|

| | | |
|---|---|---|
| I | IntroductiontoAndroidOperatingSystem–ConfigurationofAndroidEnvironment-CreatetheFirstAndroid 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 andDatePicker - 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 | Charttherequirementsneededfordevelopingandroidapplication |
| CO2 | Identify the results by executing the application in emulator or in android device |
| CO3 | Applyproperinterfacesetup,styles&themes,storingandmanagement |
| CO4 | Analyzetheproblemandaddnecessaryuserinterfacecomponents,graphicsandmultimediacomponentsintotheapplication. |
| CO5 | Evaluate theresultsbyimplementing the conceptbehindtheproblemwithpropercode. |

**Textbooks**

| | |
|---|---|
| 1 | 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/ |
| | http://appinventor.mit.edu/explore/paint-pot-extended-camera |

| **MAPPING TABLE** | | | | | | |
|---|---|---|---|---|---|---|
| **CO/PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **3** | **3** | **3** | **3** | **3** |
| **CO2** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO3** | **3** | **2** | **3** | **3** | **3** | **2** |
| **CO4** | **3** | **2** | **3** | **2** | **3** | **3** |
| **CO5** | **2** | **3** | **3** | **3** | **3** | **3** |
| **Weightageofcoursecontributedtoeach PSO** | **14** | **13** | **14** | **14** | **14** | **13** |

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

| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Marks** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | **CIA** | **External** | **Total** |
| **CC** | **MOBILE APPLICATION DEVELOPMENT LAB** | **Core** | - | - | 4 | - | 4 | 25 | 75 | 100 |

**Learning Objectives**:

LO1. To explain user defined functions and the concepts of class.
LO2. To demonstrate the creation cookies and sessions
LO3. To facilitate the creation of Database and validate the user inputs

| Lab Exercises | Required Hours |
|---|---|
| 1. Develop an application for Simple Counter.<br>2. Develop an application to display your personal details using GUI Components.<br>3. Develop a Simple Calculator that uses radio buttons and text view.<br>4. Develop an application that uses Intent and Activity.<br>5. Develop an application that uses Dialog Boxes.<br>6. Develop an application to display a Splash Screen.<br>7. Develop an application that uses Layout Managers.<br>8. Develop an application that uses different types of Menus.<br>9. Develop an application that uses to send messages from one mobile to another mobile.<br>10. Develop an application that uses to send E-mail. Develop an application that plays Audio and Video.<br>11. Develop an application that uses Local File Storage.<br>12. Develop an application for Simple Animation.<br>13. Develop an application for Login Page using Sqlite.<br>14. Develop an application for Student Marksheet processing using Sqlite. | **60** |

| Course Outcomes | |
|---|---|
| CO | On completion of this course, students will able to |
| CO1 | Understand the concepts of counter and dialogs. |
| CO2 | Concepts of Layout Managers. Perform sending email on audio and video<br>To enable the applications of audio and video. |
| CO3 | To apply Local File Storage and Development of files. |
| CO4 | To determine the concepts of Simple Animation To apply searching pages. |
| CO5 | Usage of Student mark sheet- preparation in MAD.<br>Concepts of processing Sqlite are implemented. |

**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 | 2 |
| **CO 2** | 3 | 3 | 3 | 2 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 | 2 | 3 | 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 5** | 3 | 3 | 3 | 3 | 3 | 3 |
| **Weightage of course contributed to each PSO** | 15 | 15 | 15 | 13 | 15 | 14 |

**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** |
| **CC** | **Data analytics using R** | Core | 5 | - | - | - | 4 | 5 | 25 | 75 | 100 |

| **Course Objective** | |
|---|---|
| C1 | To understand the problem solving approaches |
| C2 | To learn the basic programming constructs in R Programming |
| C3 | To learn the basic programming constructs in R Programming |
| C4 | To use R Programming data structures - lists, tuples, and dictionaries. |
| C5 | To do input/output with files in R Programming. |

| **UNIT** | **Contents** | **No. of Hours** |
|---|---|---|
| I | **Data Explosion and Big Data Analytics**: An Overview: Introduction, Evolution of Database Technology and Big Data, Elements of Big Data, Big Data System Components, Big Data Analytics – Data Analytics. Types of Big Data Analytics, Applications of Big Data Technology, Challenges and Skills required with Big Data Technology. | 15 |
| II | **Analytical Theory:** Introduction about Classification Algorithms, Regression Techniques, Domain Specific Analytic Techniques: In Database Analytics, Text Analytics.<br><br>**Real – Time Analysis:** Introduction: Real-time System, Types of Real-time System, Characteristics of Real-time Systems, Real-time Processing Systems for Big Data: Introduction, Data Integration and Analytics, | 15 |

| | | |
|---|---|---|
| | Big Data Engine-Hadoop, Real-time System Architecture, Real-time Data Analytics. | |
| III | **Big Data: Hardware, Technology Foundations**: Introduction, Big Data Stack, Virtualization and Big Data.<br><br>**Understanding NoSQL and Hadoop Ecosystem**: Introduction, NoSQL: CouchDB, MongoDB, Hadoop Ecosystem – HDFS, HBase, Yarn. | 15 |
| IV | **High Dimensional Data: A Big Data Perspective:** Introduction – What is Dimensionality? Dimensionality Reduction: Approaches for Dimensionality Reduction, Dimensionality Reduction Techniques.<br><br>**User Interface and Visualization:** Desirable Properties, Visualization Techniques.<br><br>**R Programming Basics:** Introduction, Data Types, Data Structures and Operators – Basic Data Types in R, R Operators, Vectors, List, Factor, Arrays and Matrix, Data Frame, R Programming Structure – Control Statements of R: if, if-else, if-else ladder, Switch-Case, Return, Loops and Loop Control Statements. | 15 |
| V | Interfacing R - Interfacing R to other languages – Parallel R–Basic Statistic s– Linear Model– Generalized Linear models–Non-linear Models– Time Series and Auto-Correlation– Clustering. | 15 |
| | **Total** | **75** |

| **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, PO3 |
| 3 | Learn and apply different mining algorithms and recommendation systems for large volumes of data. | PO2, PO6 |

| | | |
|---|---|---|
| | | |
| 4 | Perform analytics on data streams. | PO4, PO5, PO6 |
| 5 | Learn NoSQL databases and management. | PO5, PO6 |
| **Text Book** | | |
| 1 | **1.** Big Data Analytics – Concepts, Techniques, Tools and Technologies – First Edition, Dr.M.Thangaraj,Dr. S. Suguna, G. Sudha, PHI Learning Private Limited, Delhi,2022.<br><br>Unit I : Chapter 1<br>Unit II : Chapter 2.2.2, 2.2.4, 2.3.2, 2.3.2<br>Chapter 3 (3.1.1, 3.1.2, 3.2, 3.3.1 – 3.3.4, 3.4)<br>Unit III : Chapter 4 (4.1 – 4.3)<br>Chapter 5 (5.1, 5.2, 5.3.1 - 5.3.3)<br>Unit IV : Chapter 6.1, 6.3<br>Chapter 7.3<br>Chapter 8 (8.1 – 8.3)<br>Unit V : Chapter 8 (8.4 – 8.7) | |
| 2 | Norman Matloff,"The Art of R Programming- A Tour of Statistical Software Design", 2011 | |
| **Reference Books** | | |
| 1. | 1. Garrett Grolemund, Hadley Wickham,"Hands-On Programming with R: Write Your Own Functions and Simulations" , 1st Edition, 2014 | |
| 2. | Venables ,W.N.,andRipley,"S programming", Springer, 2000. | |
| **Web Resources** | | |
| 1. | https://www.simplilearn.com | |

**Mapping with Programme Outcomes:**

| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | **3** | **3** | **3** | **3** |
| **CO2** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO3** | **3** | **2** | **3** | **3** | **3** | **2** |
| **CO4** | **3** | **2** | **3** | **2** | **3** | **3** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **CO5** | **2** | **3** | **3** | **3** | **3** | **3** |
| **Weightageofcoursecontributedtoeach PSO** | **14** | **13** | **14** | **14** | **14** | **13** |

**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** |
| **SEC8** | **Data analytics using R Lab** | **SEC** | - | - | 4 | - | 4 | 4 | 25 | 75 | 100 |

| **Course Objective** | |
|---|---|
| C1 | To understand the problem solving approaches |
| C2 | To learn the basic programming constructs in R Programming |
| C3 | To practice various computing strategies for R Programming -based solutions to real world problems |
| C4 | To use R Programming data structures - lists, tuples, and dictionaries. |
| C5 | To do input/output with files in R Programming. |

| **Sl. No** | **Contents** | |
|---|---|---|
| 1. | Program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice. | |
| 2. | Program, to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user. | |
| 3. | Write a program to find list of even numbers from 1 to n using R-Loops. | |
| 4. | Create a function to print squares of numbers in sequence. | **60** |
| 5. | Write a program to join columns and rows in a data frame using cbind() | |

| | | |
|---|---|---|
| | and rbind() in R. | |
| 6. | Implement different String Manipulation functions in R. | |
| 7. | Implement different data structures in R (Vectors, Lists, Data Frames) | |
| 8 | Write a program to read a csv file and analyze the data in the file in R. | |
| 9 | Create pie chart and bar chart using R. | |
| 10 | 10. Create a data set and do statistical analysis on the data using R. | |
| 11 | Program to find factorial of the given number using recursive function | |
| 12 | Write a R program to count the number of even and odd numbers from array of N numbers. | |
| | **Total** | **60** |

| **Course Outcomes** | | **Programe Outcome** |
|---|---|---|
| CO | On completion of this course, students will | |
| 1 | Acquire programming skills in core R Programming | PO1,PO4,PO5 |
| 2 | Acquire Object-oriented programming skills in R Programming. | PO1, PO4,PO6 |
| 3 | Develop the skill of designing graphical-user interfaces (GUI) in R Programming | PO1,PO3,PO6 |
| 4 | Acquire R Programming skills to move into specific branches | PO3,PO4 |
| 5 | | PO1,PO5,PO6 |

| **Text Book** | |
|---|---|
| 1 | Roger D. Peng," R Programming for Data Science ", 2012 |
| 2 | Norman Matloff,"The Art of R Programming- A Tour of Statistical Software Design", 2011 |
| **Reference Books** | |
| 1 | Garrett Grolemund, Hadley Wickham,"Hands-On Programming with R: Write Your Own Functions and Simulations" , 1st Edition, 2014 |
| 2. | Venables ,W.N.,andRipley,"S programming", Springer, 2000. |
| | |

| Web Resources | |
|---|---|
| 1. | https://www.simplilearn.com |

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Instruction hour | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| **CC** | **MACHINE LEARNING** | **Core** | 5 | - | - | - | 4 | 5 | 25 | 75 | 100 |

| **Learning Objectives** | |
|---|---|
| LO1 | To Learn about Machine Intelligence and Machine Learning applications |
| LO2 | To implement and apply machine learning algorithms to real-world applications |
| LO3 | To identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems |
| LO4 | To create instant based learning |
| LO5 | To apply advanced learning |

| **UNIT** | **Contents** | **No. Of. Hours** |
|---|---|---|
| I | **Introduction Machine Learning** - Difference between AI, Machine Learning and Big data. Supervised and unsupervised learning, parametric vs non-parametric models, parametric models for classification and regression- Linear Regression, Logistic Regression, Naïve Bayes classifier, simple non-parametric classifier-K-nearest neighbour, support vector machines | **15** |
| II | **Neural networks and genetic algorithms** Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning. | **15** |
| III | **Bayesian and computational learning** Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model. | **15** |
| IV | **Instant based learning** K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning. | **15** |
| V | **Advanced learning** Recommendation systems – opinion mining, sentiment analysis. Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q- | **15** |

| | | |
|---|---|---|
| | Learning – Temporal Difference Learning. | |
| | **TOTAL HOURS** | **75** |

| **Course Outcomes** | | **Programme Outcomes** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Appreciate the importance of visualization in the data analytics solution | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO2 | Apply structured thinking to unstructured problems | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO3 | Understand a very broad collection of machine learning algorithms and problems | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO4 | Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theor | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO5 | Develop an appreciation for what is involved in learning from data. | PO1, PO2, PO3, PO4, PO5, PO6 |

| | |
|---|---|
| 1 | Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013. |
| 2 | Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning" 2015, MIT Press |

**Reference Books**

| | | |
|---|---|---|
| 1. | | EthemAlpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004. |
| 2 | | Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009. |

**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 | 2 | 3 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **CO 4** | 3 | 3 | 2 | 3 | 3 | 3 |
| **CO 5** | 3 | 3 | 3 | 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** | **Instruction Hours** | **Credits** | **Marks** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | **CIA** | **External** | **Total** |
| **CC** | MACHINE LEARNING LAB | **Core** | - | - | 4 | - | 4 | 4 | 25 | 75 | 100 |

**Learning Objectives**:

To apply the concepts of Machine Learning to solve real-world problems and to implement basic algorithms in clustering & classification applied to text & numeric data

| **LAB EXERCISES** | Required Hours |
|---|---|
| 1. Solving Regression & Classification using Decision Trees<br>2. Root Node Attribute Selection for Decision Trees using Information Gain<br>3. Bayesian Inference in Gene Expression Analysis<br>4. Pattern Recognition Application using Bayesian Inference<br>5. Bagging in Classification<br>6. Bagging, Boosting applications using Regression Trees<br>7. Data & Text Classification using Neural Networks<br>8. Using Weka tool for SVM classification for chosen domain application<br>9. Data & Text Clustering using K-means algorithm<br>10. Data & Text Clustering using Gaussian Mixture Models | **60** |

| **Course Outcomes** |
|---|

| CO | On completion of this course, students will |
|---|---|
| CO1 | Effectively use the various machine learning tools |
| CO2 | Understand and implement the procedures for machine learning algorithms |
| CO3 | Design Python programs for various machine learning algorithms |
| CO4 | Apply appropriate datasets to the Machine Learning algorithms |
| CO5 | Analyze the graphical outcomes of learning algorithms with specific datasets |

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

**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** |
| **CC** | **Data mining and warehousing** | Core | 5 | - | - | - | 4 | 5 | 25 | 75 | 100 |

| **Learning Objectives** | |
|---|---|
| LO1 | To provide the knowledge on Data Mining and Warehousing concepts and techniques |
| LO2 | To study the basic concepts of Data Mining, Architecture and Comparison. |
| LO3 | To study a set of Mining Association Rules, Data Warehouses. |
| LO4 | To study about Classification and Prediction, Classifier Accuracy |
| LO5 | To study the basic concepts of cluster analysis, Cluster Methods |

| **UNIT** | **Contents** | **No. of Hours** | **Course Objectives** |
|---|---|---|---|

| | | |
|---|---|---|
| I | Introduction: Data mining – Functionalities – Classification – Introduction to Data Warehousing – Data Preprocessing: Preprocessing the Data – Data cleaning – Data Integration and Transformation – Data Reduction | 15 |
| II | Data Mining, Primitives, Languages and System Architecture: Data Mining – Primitives – Data Mining Query Language, Architecture of Data mining Systems. Concept Description, Characterization and Comparison: Concept Description, Data Generalization and Summarization, Analytical Characterization, Mining Class Comparison – Statistical Measures. | 15 |
| III | Mining Association Rules: Basic Concepts – Single Dimensional Boolean Association Rules From Transaction Databases, Multilevel Association Rules from transaction databases – Multi dimension Association Rules from Relational Database and Data Warehouses. | 15 |
| IV | Classification and Prediction: Introduction – Issues – Decision Tree Induction – Bayesian Classification – Classification of Back Propagation. Classification based on Concepts from Association Rule Mining – Other Methods. Prediction – Introduction – Classifier Accuracy | 15 |
| V | Cluster Analysis: Introduction – Types of Data in Cluster Analysis, Petitioning Methods – Hierarchical Methods-Density Based Methods – GRID Based Method – Model based Clustering Method | 15 |
| | **Total** | **75** |

**Course Outcomes**

| **Course Outcomes** | On completion of this course, students will; | |
|---|---|---|
| **CO1** | To understand the basic concepts and the functionality of the various data mining and data warehousing component | PO1, PO3, PO6, PO8 |
| **CO2** | To know the concepts of Data mining system architectures | PO1,PO2,PO3,PO6 |
| **CO3** | To analyze the principles of association rules | PO3, PO5 |

| | | |
|---|---|---|
| **CO4** | To get analytical idea on Classification and prediction methods | PO1, PO2, PO3, PO5 |
| **CO5** | To Gain knowledge on Cluster analysis and its methods. | PO2, PO4, PO6 |
| **Text Books (Latest Editions)** | | |
| 1. | Han and M. Kamber, "Data Mining Concepts and Techniques", 2001, Harcourt India Pvt. Ltd, New Delhi. | |
| **References Books (Latest editions)** | | |
| 1. | K.P. Soman, ShyamDiwakar, V. Ajay "Insight into Data Mining Theory and Practice ",Prentice Hall of India Pvt. Ltd, New Delhi | |
| 2. | Parteek Bhatia, 'Data Mining and Data Warehousing: Principles and Practical Techniques', Cambridge University Press, 2019 | |
| **Web Resources** | | |
| 1. | https://www.topcoder.com/thrive/articles/data-warehousing-and-data-mining#:~:text=Data%20warehousing%20is%20a%20method,compiled%20in%20the%20data%20warehouse. | |
| 2. | https://www.javatpoint.com/data-mining-cluster-vs-data-warehousing | |
| 3. | https://www.tutorialspoint.com/Data-Warehousing-and-Data-Mining | |

**Mapping with Programme Outcomes:**

| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | **3** | **3** | **3** | **3** |
| **CO2** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO3** | **3** | **2** | **3** | **3** | **3** | **2** |
| **CO4** | **3** | **2** | **3** | **2** | **3** | **3** |
| **CO5** | **2** | **3** | **3** | **3** | **3** | **3** |
| **Weightageofcoursecontributedtoeach PSO** | **14** | **13** | **14** | **14** | **14** | **13** |

**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 |
| **CC** | **SOFTWARE METRICS** | **Core** | **-** | **5** | **-** | **-** | **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,<br>**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:** Classifying<br>software measures, Determining what to Measure, Applying the framework, Software measurement validation, Performing SoftwareMeasurementValidation<br>**Empirical investigation**: Principles of Empirical Studies, Planning<br>Experiments, 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<br>**Analyzing software measurement data:** Statistical distributions and<br>hypothesis 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<br>**Measuring internal product attributes: Structure:** Aspects of Structural Measures, Control flow structure of program units, Design-levelAttributes, Object-oriented | **15** |

| | | |
|---|---|---|
| | Structural attributes and measures | |
| V | **Measuring External Product Attributes:** Modelling software quality, Measuring aspects of quality, Usability Measures, Maintainability measures,SecurityMeasures<br>**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**

| | |
|---|---|
| 1 | 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/ |

**Mapping with Programme Outcomes:**

| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 3 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 2 | 3 | 3 |
| CO5 | 2 | 3 | 3 | 3 | 3 | 3 |
| Weightageofcoursecontributedtoeach PSO | 14 | 13 | 14 | 14 | 14 | 13 |

**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 |
| CC | Network Security | Core | 5 | - | - | - | 4 | 5 | 25 | 75 | 100 |

| Course Objectives | |
|---|---|
| CO1 | To familiarize on the model of network security, Encryption techniques |
| CO2 | To understand the concept of Number Theory , theorems |
| CO3 | To understand the design concept of cryptography and authentication |
| CO4 | To develop experiments on algorithm used for security |
| CO5 | To understand about virus and threats, firewalls, and implementation of Cryptography |

| UNIT | Contents | 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 | 15 |

| | | |
|---|---|---|
| | linear cryptanalysis – Placement of encryption function – traffic confidentiality. | |
| 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** | Analyze and design classical encryption techniques and block ciphers. | PO1, PO3, PO6 |
| **CO2** | Understand and analyze public-key cryptography, RSA and other public-key cryptosystems such as Diffie-Hellman Key Exchange, ElGamal Cryptosystem, etc | PO1,PO2,PO3,PO5 |
| **CO3** | Understand key management and distribution schemes and design User Authentication | PO4, PO5 |
| **CO4** | Analyze and design hash and MAC algorithms, and digital signatures. | PO1, PO2, PO3, PO6 |
| **CO5** | Know about Intruders and Intruder Detection mechanisms, Types of Malicious software, | P02, PO6 |

| Reference Text : | |
|---|---|
| 1. | William Stallings, "Cryptography & Network Security", Pearson Education, Fourth Edition 2010. |
| **References** | |
| 1. | CharlieKaufman,RadiaPerlman,MikeSpeciner,"NetworkSecurity,Privatecommunication inpublicworld",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 with Programme Outcomes:**

| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | **3** | **3** | **3** | **3** |
| **CO2** | **3** | **3** | **2** | **3** | **2** | **2** |
| **CO3** | **3** | **2** | **3** | **3** | **3** | **2** |
| **CO4** | **3** | **2** | **3** | **2** | **3** | **3** |
| **CO5** | **2** | **2** | **2** | **2** | **3** | **3** |
| **Weightageofcoursecontributedtoeach PSO** | **14** | **12** | **13** | **13** | **14** | **13** |

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

# Annexure I

## 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. Digital Logic Fundamentals
6. Numerical Methods
7. Optimization Techniques
8. Nano Technology
9. Introduction to Linear Algebra
10. Graph Theory and its Application
11. Resource Management Techniques and more

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CIA | External | Total |
| **EC-GS** | Discrete Mathematics – I | **Elect** | 4 | - | - | | 3 | 25 | 75 | 100 |
| **Learning Objectives** | | | | | | | | | | |
| **LO1** | To understand the mathematical concepts like set theory, logics, number theory, combinatory and relations. | | | | | | | | | |
| **LO2** | To Explain the Relations concepts and their properties | | | | | | | | | |
| **LO3** | To know the Applications of recurrence relations | | | | | | | | | |
| **LO4** | To understand the Graphs and Graphs models | | | | | | | | | |
| **LO5** | To explain the Matrices concepts | | | | | | | | | |
| **UNIT** | **Contents** | | | | | | | | | **No. Of. Hours** |
| I | ***SET THEORY*** Introduction- set and Its Element – Set Description (Roster, Set | | | | | | | | | **12** |

| | | |
|---|---|---|
| | Builder and cardinal number method) Types of Sets- Set Operations and Laws of set Theory. Partition of sets. Minsets- Countable and un Countable set. Algebra of sets andDuality | |
| II | ***MATHEMATICAL LOGIC***<br>Basic Logic and Proof, logical operations – Logic Propositional equivalence, Predicates and Quantities, Tautology-Contradiction- Methods of proofs(Direct and Indirect)- Function- Definition- Notation- Types of Function- Composition of Functions- | **12** |
| III | ***NUMBER THEORY***<br>The Integers and Division, Integers and Algorithms,(Multiplication, Addition and Division-Sequences and Summations, Recursive algorithms, Program correctness | **12** |
| IV | ***COMBINATORICS*:**<br>The basics of counting, the pigeonhole principle, Permutations and Combinations, Binomial coefficients, Generalized permutations and combinations | **12** |
| V | ***RELATIONS***<br>Relations – Relations and their properties, Representing Relations, Closures of relations, Equivalence relations, Partial orderings- Recurrence Relations Binary Relations. | **12** |

| **Total hours** | | **60** |
|---|---|---|
| **Course Outcomes** | | **Programme Outcomes** |
| CO | On completion of this course, students will | |
| CO1 | To understand the mathematical concepts like set theory, logics, number theory, combinatory and relations. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO2 | To understand different mathematical logics and functions | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO3 | To Understanding the different form of number theory | PO1, PO2, PO3, PO4, PO5, PO6 |

| | | |
|---|---|---|
| CO4 | To gain knowledge on set theory | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO5 | Able to understand Relations and its applications | PO1, PO2, PO3, PO4, PO5, PO6 |
| **Textbooks** | | |
| 1 | Discrete Mathematics and its applications, Seventh Edition, Kenneth.H.Rosen, McGrawHill Publishing Company, 2012. | |
| 2 | Discrete Mathematics, M.Venkataraman, N.Sridharan and N.Chandrasekaran, The National Publishing Company, 2009.<br>Unit I : Textbook 1 Chapter 1: Sections: 1.1, 1.2, 1.3, 1.4, 1.6<br>Unit II : Textbook 1 Chapter 9: Sections: 9.1, 9.3, 9.4, 9.5, 9.6<br>Unit III : Textbook 1 Chapter 6: Sections: 6.1, 6.2, 6.3<br>Chapter 8: Sections: 8.1, 8.2, 8.3 (Pages: 527 -529 only)<br>(Exclude algorithms and relations, on page 507 and its related problems)<br>Unit IV : Textbook 1 Chapter 10: Sections: 10.1, 10.2, 10.3, 10.4, 10.6)<br>Unit V : Textbook 2 Chapter 6 :Sections :6.1 to 6.5, and 6.7) | |
| 3. | J.K Sharma “DISCRETE MATHEMATICS” 3 rd Edition Macmillan Reprint2011 | |
| **Reference Books** | | |
| 1. | Modern Algebra - S.Arumugam and A. Thangapandi Isaac, Scitechpublications 2005. | |
| 2. | Invitation to Graph Theory-S.Arumugam and S.Ramachandran, Scitech Publications,2005, Chennai. | |
| 3. | Discrete Mathematical Structures with applications to Computer Science - Tremblay and Manohar, McGraw Hill,1997. | |
| **Web Resources** | | |
| 1. | Web resources from NDL Library, E-content from open-source libraries | |

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CIA | External | Total |
| EC-GS | Discrete Mathematics-II | **Elect** | 4 | - | - | | 3 | 25 | 75 | 100 |

| **Learning Objectives** | |
|---|---|
| **LO1** | To introduce the Data Models |
| **LO2** | To explain the Logic & Proofs |
| **LO3** | To understanding the Relational Structures on Sets |
| **LO4** | To know the Counting &Combinatorics |
| **LO5** | To explain the Algebraic Structures |

| UNIT | Contents | No. Of. Hours |
|---|---|---|
| I | **Sets and Sequences: Data Models.**<br>Finite Sets, Power Set, Cardinality of finite sets, Cartesian Product, Properties of Sets, Vector Implementations of Sets. | **12** |
| II | **Describing Sets : Logic & Proofs**<br>Introduction to Logic. Propositional Logic, Truth tables, Deduction, Resolution, Predicates and Quantifiers, Mathematical Proofs. Infinite sets, well-ordering. Countable and Uncountable sets, Cantor's diagonalization. Mathematical Induction - weak and strong induction. | **12** |
| III | **Relational Structures on Sets : Relations & Graphs**<br>Relations, Equivalence Relations. Functions, Bijections. Binary relations and Graphs. Trees (Basics). Posets and Lattices, Hasse Diagrams. Boolean Algebra. | **12** |
| IV | **Sizes of Sets : Counting &Combinatorics**<br>Counting, Sum and product rule, Principle of Inclusion Exclusion. Pigeon Hole Principle, Counting by Bijections. Double Counting. Linear Recurrence relations - methods of solutions. Generating Functions. Permutations and counting. | **12** |
| V | **Structured Sets : Algebraic Structures**<br>Structured sets with respect to binary operations. Groups, Semigroups, Monoids. Rings, and Fields. Vector Spaces, Basis. | **12** |
| **Total hours** | | **60** |

| Course Outcomes | | Programme Outcomes |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Understanding the concepts of Sets and Sequences | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO2 | To know the concepts of Logic & Proofs | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO3 | Understanding the Relations & Graphs | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO4 | To explain he Sum and product rule | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO5 | To understating the concepts of Algebraic Structures | PO1, PO2, PO3, PO4, PO5, PO6 |
| **Textbooks** | | |
| 1 | Discrete Mathematics and its Applications - Kenneth H. Rosen 7th Edition -Tata McGraw Hill Publishers - 2007 | |
| **Reference Books** | | |
| 1. | Elements of Discrete Mathematics, C. L Liu, McGraw-Hill Inc, 1985. Applied Combinatorics, Alan Tucker, 2007. | |
| 2. | Concrete Mathematics, Ronald Graham, Donald Knuth, and Oren Patashnik, 2nd Edition - Pearson Education Publishers - 1996. | |
| 3. | Combinatorics: Topics, Techniques, Algorithms by Peter J. Cameron, Cambridge University Press, 1994 (reprinted 1996). | |
| 4. | Topics in Algebra, I.N. Herstein, Wiley, 1975. | |
| **Web Resources** | | |
| 1. | Web resources from NDL Library, E-content from open-source libraries | |

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CIA | External | Total |
| EC-GS | Statistical Methods and its Application-I | Elect | 4 | - | - | | 3 | 25 | 75 | 100 |

| Learning Objectives | |
|---|---|
| LO1 | To make understand the fundamentals of Statistics. |
| LO2 | Define the principal concepts about probability. |
| LO3 | To explain the Coefficient of Variation |
| LO4 | To understand the concept of Conditional Probability |
| LO5 | Explain the concept of a random variable and the probability distributions. |

| UNIT | Contents | No. Of. Hours |
|---|---|---|
| I | Introduction to statistics – primary and secondary data – classification, tabulation and Diagrammatic Representation of statistical data – Bar-charts, Pie-diagrams' – Graphical Representation of data – Histograms, Frequency polygon, Ogives. | 12 |
| II | Measures of dispersion – characteristics – coefficient of dispersion - Coefficient of variation – Moments – skewness and kurtosis – Pearson's coefficient of skewness - Bowley's coefficient of Skewness – Coefficient of skewnessbased upon moments. | 12 |
| III | Simple correlation – Karl Pearson's coefficient of correlation – correlation coefficient for A bivariate frequency distribution – Rank correlation – Regression – lines of regression – Properties of regression coefficient. | 12 |
| IV | Events and sets – sample space – concept of probability – addition and multiplications Theorem on probability – conditional probability and independence of evens – Baye's Theorem – concept of random variable – Mathematical Expectation. | 12 |
| V | Concept of sampling distributions – standard error – Tests of significance basedont, Chi-squareandFdistributionswithrespect to mean,variance. | 12 |

| Total hours | | 60 |
|---|---|---|
| **Course Outcomes** | | **Programme Outcomes** |
| CO | On completion of this course, students will | |
| CO1 | Summarize the concepts of statistical methods | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO2 | Analyse the different Statistical measures of data | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO3 | Derive the marginal and conditional distributions of random variables, translate realworld problems into probability models | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO4 | To understanding the concepts of Probability of an event | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO5 | Understand basic probability axioms and rules and the moments of discrete and continuous random variables as well as be familiar with common named discrete and continuous random variables | PO1, PO2, PO3, PO4, PO5, PO6 |
| **Textbooks** | | |
| 1 | Statistical Methods, S.P.Gupta, Sultan Chand and sons Publications,4th Edition 2011 | |
| **Reference Books** | | |
| 1. | Statistics, Dr. S.Arumugam and A.ThangapandiIssac, New Gamma Publication house, 2002. | |
| 2. | KishorS. Trivedi - Probability and statistics with reliability queuing and Computer Science Applications - Prentice Hall of India (P) Ltd., New Delhi -1997 | |
| 3. | Discrete Mathematics - Seymour Lipschutz, Marc Lars Lipson Schaum‘s Outlines- by, 3rd Edition., Tata McGraw Hill, Education Pvt. Ltd., New Delhi. 5th Reprint, 2012 | |
| **Web Resources** | | |
| 1. | Web resources from NDL Library, E-content from open-source libraries | |

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CIA | External | Total |
| EC-GS | Statistical Methods and its Application-II | Elect | 4 | - | - | | 3 | 25 | 75 | 100 |

| Learning Objectives | |
|---|---|
| LO1 | To introduce the concepts of statistics |
| LO2 | To know the concepts of Bowley's coefficient of Skewness – Coefficient of skewness based upon moments |
| LO3 | To explain the concepts of simple correlation |
| LO4 | To understanding the concept of Mathematical Expectation |
| LO5 | To know the standard error |

| UNIT | Contents | No. Of. Hours |
|---|---|---|
| I | Introduction to statistics – primary and secondary data – classification, tabulation and Diagrammatic Representation of statistical data – Bar-charts, Pie diagrams' – Graphical Representation of data – Histograms, Frequency polygon, Ogives. | 12 |
| II | Measures of dispersion – characteristics – coefficient of dispersion - Coefficient of variation-Moments – skewness and kurtosis – Pearson's coefficient of skewness - Bowley's coefficient of Skewness – Coefficient of skewness based upon moments. | 12 |
| III | Simple correlation – Karl Pearson's coefficient of correlation – correlation coefficient for A bivariate frequency distribution – Rank correlation – Regression lines of regression – Properties of regression coefficient | 12 |
| IV | Events and sets – sample space – concept of probability – addition and multiplications Theorem on probability – conditional probability and independence of evens – Baye's Theorem – concept of random variable – Mathematical Expectation. | 12 |
| V | Concept of sampling distributions – standard error- Tests of significance based on t, Chi- square and F distributions with respect to mean, variance. | 12 |

| Total hours | | 60 |
|---|---|---|
| **Course Outcomes** | | **Programme Outcomes** |
| CO | On completion of this course, students will | |
| CO1 | summarize the concepts of statistics | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO2 | Analyzing the concepts -Bowley‘s coefficient of Skewness – Coefficient of skewness based upon moments | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO3 | To understanding the concepts of simple correlation | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO4 | To understanding the concept of Mathematical Expectation | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO5 | To know the test of significance | PO1, PO2, PO3, PO4, PO5, PO6 |
| **Textbooks** | | |
| 1 | Statistical Methods, S.P.Gupta, Sultan Chand and sons Publications,4th Edition 2011 | |
| **Reference Books** | | |
| 1. | Statistics, Dr. S.Arumugam and A.ThangapandiIssac, New Gamma Publication house, 2002. | |
| 2. | KishorS. Trivedi - Probability and statistics with reliability queuing and Computer Science Applications - Prentice Hall of India (P) Ltd., New Delhi -1997 | |
| 3. | Discrete Mathematics - Seymour Lipschutz, Marc Lars Lipson Schaum‘s Outlines- by, 3rd Edition., Tata McGraw Hill, Education Pvt. Ltd., New Delhi. 5th Reprint, 2012 | |
| **Web Resources** | | |
| 1. | Web resources from NDL Library, E-content from open-source libraries | |

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CIA | External | Total |
| **EC-GS** | Digital Logic Fundamentals | **Elect** | 4 | - | - | | 3 | 25 | 75 | 100 |

| **Learning Objectives** | |
|---|---|
| **LO1** | ItaimstotrainthestudenttothebasicconceptsofDigitalLogicFundamentals |
| **LO2** | To impart the in-depth knowledge of logic gates, Booleanalgebra,combinationalcircuitsandsequentialcircuits. |
| **LO3** | To explain the concept of Combinational Logic and counters |
| **LO4** | To introduce the concepts of Flip-Flops, Registers |
| **LO5** | To explain the Asynchronous and Synchronous Counters |

| **UNIT** | **Contents** | **No. Of. Hours** |
|---|---|---|
| I | NumberSystemsandCodes:NumberSystem–BaseConversion – BinaryCodes – Code Conversion. Digital Logic: Logic Gates – Truth Tables – UniversalGates. | **12** |
| II | Boolean Algebra: Laws and Theorems – SOP, POS Methods – Simplification ofBooleanFunctions– UsingTheorems,K-Map,Prime–ImplicantMethod–Binary Arithmetic: Binary Addition – Subtraction – Various Representations ofBinaryNumbers– ArithmeticBuildingBlocks–Adder–Subtractor. | **12** |
| III | Combinational Logic: Multiplexers – Demultiplexers – Decoders – Encoders –CodeConverters– ParityGeneratorsandCheckers. | **12** |
| IV | SequentialLogic:RS,JK,D,andTFlip-Flops–Master-Slave Flip-Flops.Registers:ShiftRegisters–TypesofShiftRegisters. | **12** |
| V | Counters: Asynchronous and Synchronous Counters - Ripple, Mod, Up-DownCounters– Ring Counters. Memory: Basic Terms and Ideas –Types of ROMs –TypesofRAMs. | **12** |
| **Total hours** | | **60** |

| **Course Outcomes** | | **Programme Outcomes** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Identify the logic gates and their functionality. | PO1, PO2, PO3, PO4, PO5, PO6 |

| | | |
|---|---|---|
| CO2 | Perform number conversions from one system to another system | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO3 | Understand the functions of combinational circuits | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO4 | Perform number conversions | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO5 | Perform Counter design and learn its operations | PO1, PO2, PO3, PO4, PO5, PO6 |

**Textbooks**

| | |
|---|---|
| 1 | V.RajaramanandT.Radhakrishnan,*Digital Computer Design*, Prentice HallofIndia,2001 |
| 2 | D.P.LeachandA.P.Malvino,*DigitalPrinciplesandApplications*–TMH–FifthEdition–2002 |
| 3 | M.MorisMano,*DigitalLogicandComputerDesign*,PHI,2001 |
| 4 | T.C.Bartee,*DigitalComputerFundamentals*,6thEdition,TataMcGrawHill,1991 |

**Web Resources**

| | |
|---|---|
| 1. | Web resources from NDL Library, E-content from open-source libraries |

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CIA | External | Total |
| **EC-GS** | Numerical Methods | **Elect** | 4 | - | - | | 3 | 25 | 75 | 100 |

**Learning Objectives**

| | |
|---|---|
| **LO1** | To introduce the various topics in Numerical methods. |
| **LO2** | To make understand the fundamentals of algebraic equations. |
| **LO3** | To apply interpolation and approximation on examples. |
| **LO4** | To solve problems using numerical differentiation and integration |
| **LO5** | To solve linear systems, numerical solution of ordinary differential equations. |

| UNIT | Contents | No. Of. Hours |
|---|---|---|
| I | FUNDAMENTALS OF ALGEBRAIC EQUATION: Solution of | **12** |

| | | |
|---|---|---|
| | algebraic and transcendental equations-Bisection method – Fixed point iteration method – Newton Raphson method –linear system of equations – Gauss elimination method – Gauss Jordan method . | |
| II | ITERATIVE, INTERPOLATION AND APPROXIMATION: Iterative methods - Gauss Jacobi and Gauss Seidel – Eigen values of a matrix by Power method and Jacobi's method for symmetric matrices. Interpolation with unequal intervals – Lagrange's interpolation – Newton's divided difference interpolation | **12** |
| III | INTERPOLATION WITH EQUAL INTERVAL: Difference operators and relations. -Interpolation with equal intervals – Newton's forward and backward difference formulae. | **12** |
| IV | NUMERICAL DIFFERENTIATION AND INTEGRATION: Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal, Simpson's 1/3 rule | **12** |
| V | INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS: Single step methods – Taylor's series method – Euler's method – Modified Euler's method - RungeKutta method for solving( first, second , Third and 4th) order equations – Multi step methods | **12** |
| **Total hours** | | **60** |

| **Course Outcomes** | | **Programme Outcomes** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Know how to solve various problems on numerical methods | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO2 | Use approximation to solve problems | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO3 | Differentiation and integration concept are applied | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO4 | Apply , direct methods for solving linear systems | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO5 | Numerical solution of ordinary differential equations | PO1, PO2, PO3, PO4, PO5, PO6 |

| Textbooks | |
|---|---|
| 1 | Numerical Methods, Second Edition, S.Arumugam, A.ThangapandiIssac, A.Somasundaram, SCITECH publications, 2009. |
| **Reference Books** | |
| 1. | Mathews J.H. Numerical Method for Maths, Science and Engineering; PHI, New Delhi, 2001 |
| 2. | Iqbal H. Khan & Q. Hassan Numerical Methods for Engineers and Scientist - Galgotia Publications (P) Ltd., New Delhi – 1997 |
| 3. | M.K. Jain, S.R.K. Iyengar&R.K.Jain - Numerical Methods for Scientific and Engineering Computation - New Age International(P) Ltd., New Delhi – 1996. |
| **Web Resources** | |
| 1. | Web resources from NDL Library, E-content from open-source libraries |

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CIA | External | Total |
| **EC-GS** | Optimization Techniques | **Elect** | 4 | - | - | | 3 | 25 | 75 | 100 |

| Learning Objectives | | |
|---|---|---|
| **LO1** | To introduce the concepts of Linear Programming | |
| **LO2** | Insights into the Simplex method | |
| **LO3** | To explain the Transportation Problem | |
| **LO4** | To understanding the concepts of Assignment Problem | |
| **LO5** | To know the Scheduling Techniques | |
| **UNIT** | **Contents** | **No. Of. Hours** |
| I | Linear Programming :Linear Programming Problem –Assumptions of Linear Programming Problem – Three Stages of Linear Programming Problem – Limitations of Linear Programming – Formulating a | **12** |

| | | |
|---|---|---|
| | Problem as Linear Programming Model – Illustrative examples of LP Model Formulation -General Linear Programming Problem - Canonical and Standard forms of LPP- Terminology for the solution of LPP- Solving Linear Programming Problems: Graphical Solution method. | |
| II | Insights into the Simplex method – The computational procedure – Simplex Algorithm – Use of Artificial variables – Two-Phase Method – Big-M method – Degeneracy and Unboundedness in Linear Programming. | **12** |
| III | Transportation Problem: General Structure of a Transportation Problem –Existence of solution and degeneracy in Transportation Problem - Standard transportation table -Solution of a Transportation Problem – Methods for finding Initial Basic feasible solution -Optimality TestStepping Stone method - MODI method - Unbalanced Transportation Problem. | **12** |
| IV | Assignment Problem: Model formulation of an Assignment Problem – Assumptions in Assignment Problem - Methods of solving an Assignment Problem – The Hungarian Assignment algorithm – Special cases in Assignment Problems - Maximization cases in Assignment Problems – Prohibited Assignments. | **12** |
| V | Scheduling Techniques: Why networks? - Basic components of Network – Logical Sequencing - Rules of Network Construction –Network Scheduling - Critical Path Analysis-Critical Path Calculations – Procedure for determining Critical Path. | **12** |
| **Total hours** | | **60** |

| **Course Outcomes** | | **Programme Outcomes** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | summarize various algorithms and rules used in solving OR problems. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO2 | solve all problems of Linear Programming, Transportation, Assignment and Network scheduling. | PO1, PO2, PO3, PO4, PO5, PO6 |

| | | |
|---|---|---|
| CO3 | analyze various problems for infeasibility, degeneracy, unboundedness and alternate solutions. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO4 | find the best suitable method for obtaining optimal solution to Linear Programming, Transportation, Assignment problems. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO5 | formulate the real world decision making problems into mathematical models. | PO1, PO2, PO3, PO4, PO5, PO6 |

**Textbooks**

| | |
|---|---|
| 1 | KantiSwarup, P.K.Gupta and Manmohan(2022) , "Operations Research", Sultan Chand & Sons, Twentieth Revised Edition. |

**Reference Books**

| | |
|---|---|
| 1. | J..K.Sharma(2017), "Operations Research Theory and Applications", Lakshmi Publications, Sixth Edition. |
| 2. | G.Srinivasan (2017), "Operations Research", PHI Learning Private Limited, Third Edition. |

**Web Resources**

| | |
|---|---|
| 1. | https://nptel.ac.in/courses/111107128 |
| 2 | https://nptel.ac.in/courses/110106062 |

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CIA | External | Total |
| EC-GS | Nano Technology | Elect | 4 | - | - | | 3 | 25 | 75 | 100 |

**Learning Objectives**

| | |
|---|---|
| **LO1** | To introduce the concepts of nanoscience and nanotechnology |
| **LO2** | Define the nano system |
| **LO3** | To explain the importance of Nanotechnology |
| **LO4** | To explain the concepts of Nanostructured materials |
| **LO5** | To know the advanced concepts of nano technology |

| UNIT | Contents | No. Of. Hours |
|---|---|---|
| I | Background to nanoscience and nanotechnology - scientific revolutions - nanosizedeffectssurface to volume ratio- – atomic | **12** |

| | | |
|---|---|---|
| | structure – molecules & phases – energy at the nanoscale molecular and atomic size -quantum effects- types of nanotechnology and nano machines | |
| II | Definition of a nano system - classification of nanocrystals - dimensionality and size dependent phenomena; Quantum dots, Nanowires and Nanotubes, 2D films; | **12** |
| III | Nano &mesopores – top down and bottom up- Misnomers and misconception of Nanotechnology importance of the nanoscale materials and their devices -size dependent variation in mechanical, physical and chemical, magnetic, electronic transport, reactivity etc., | **12** |
| IV | Nanostructured materials-metal-semiconductor-ceramics and composites- size dependent properties - uniqueness in these properties compared to bulk and microscopic solids– nanomaterials and nanostructures in nature- super hydrophobicity, self-cleaning - antifogging. | **12** |
| V | Recent special nanomaterials - Carbon based nanomaterials – CNT- graphene-core-shell structures- Micro and Mesopores Materials- Organic-Inorganic Hybrids- ZnO- Silicon -- DNA- RNA- Nanoproducts | **12** |
| **Total hours** | | **60** |

| **Course Outcomes** | | **Programme Outcomes** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Understanding the concepts of nanoscience and nanotechnology | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO2 | To explain the classification of nanocrystals | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO3 | To understanding the importance of Nanotechnology | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO4 | Explain the nanomaterials and nanostructures in nature | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO5 | Design processing conditions to functional nanomaterials | PO1, PO2, PO3, PO4, PO5, PO6 |

| Textbooks | |
|---|---|
| 1 | Introduction to Nanoscience and Nanotechnology, Gabor .L et al, |
| **Reference Books** | |
| 1. | "Nanostructures &Nanomaterials: Synthesis, Properties &Applications" G. Cao, Imperial College Press, 2004. |
| 2. | Nanomaterials, Nanotechnologies and Design: An introduction for engineers andArchitects, Micheal F. Ashby, P.J. Ferreria, D.L. Schodek, |
| 3 | Fundamentals of Nanotechnology, Hornyak, G. Louis, Tibbals, H. F., Dutta, Joydeep,CRC Press, 2009 |
| 4 | Nanomaterials: An introduction to synthesis, properties and application, Dieter Vollath,WILE-VCH, 2008 |
| **Web Resources** | |
| 1. | Web resources from NDL Library, E-content from open-source libraries |

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CIA | External | Total |
| **EC-GS** | Introduction to Linear Algebra | **Elect** | 4 | - | - | | 3 | 25 | 75 | 100 |

| Learning Objectives | | |
|---|---|---|
| **LO1** | Introduce students to the theory of systems of linear equations and to mathematical proof | |
| **LO2** | To explain the concepts Matrix of a linear transformation. | |
| **LO3** | To understanding the Inner product Spaces | |
| **LO4** | To explain the Matrices | |
| **LO5** | To understanding the Bilinear forms | |
| **UNIT** | **Contents** | **No. Of. Hours** |

| | | |
|---|---|---|
| I | Vector spaces: Definitions and Examples – Subspaces – Linear Transformations - Span of a set. | **12** |
| II | Linear independence – Basis and dimensions – Rank and Nullity – Matrix of a linear transformation. | **12** |
| III | Inner product Spaces: Definition and examples – Orthogonality – Orthogonal Complement. | **12** |
| IV | Matrices – Elementary transformations – Rank of a matrix – Simultaneous linear equations – Characteristic equations and Cayley Hamilton theorem – Eigen values and eigen vectors. | **12** |
| V | Bilinear forms – Quadratic forms. | **12** |
| **Total hours** | | **60** |

| **Course Outcomes** | | **Programme Outcomes** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | The concepts of linear algebra are crucial for understanding the theory behind machine learning, especially for deep learning. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO2 | Prove statements of an algebraic nature concerning linear transformations | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO3 | Calculate eigenvalues and their corresponding eigenspaces | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO4 | DetermineRank of a matrix | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO5 | Understand **algebraic** and geometric representations | PO1, PO2, PO3, PO4, PO5, PO6 |

**Textbooks**

| | |
|---|---|
| 1 | Dr. S. Arumugam and Prof. A. Thangapandi Isaac, Modern Algebra, SciTech Publication, India Private Ltd., January 2018.<br>Unit I: Chapter 5 – Sections 1, 2, 3 and 4<br>Unit II: Chapter 5 – Sections 5, 6, 7 and 8<br>Unit III: Chapter 6 – Sections 1, 2 and 3<br>Unit IV: Chapter 7 – Sections 4, 5, 6, 7 and 8 |

| | |
|---|---|
| | Unit V: Chapter 8 – Sections 1 and 2. |

**Reference Books**

| | |
|---|---|
| 1. | I. N. Herstein, Topics in Algebra, Wiley Eastern Ltd, 2006. |
| 2. | A. R. Vasishtha, Modern Algebra, Krishna Publication, January 2015 |

**Web Resources**

| | |
|---|---|
| 1. | Web resources from NDL Library, E-content from open-source libraries |

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CIA | External | Total |
| **EC-GS** | Graph Theory and its Application | **Elect** | 4 | - | - | | 3 | 25 | 75 | 100 |

**Learning Objectives**

| | |
|---|---|
| **LO1** | Definition of Graph, sub graph their representations, degree and algebraic operations. |
| **LO2** | Connected graphs, weighted graphs and shortest paths |
| **LO3** | Trees: Characterizations, spanning tree, minimum spanning trees |
| **LO4** | Eulerian and Hamiltonian graphs: Characterization, Necessary and sufficient conditions |
| **LO5** | Special classes of graphs: Bipartite graphs, line graphs, chordal graphs |

| UNIT | Contents | No. Of. Hours |
|---|---|---|
| I | **INTRODUCTION**: Graph-mathematical definition- Introduction – sub graphs –Walks, paths, Circuits connectedness- Components- Euler Graphs- Hamiltonian paths and circuits-Trees- properties of Trees- Distance and centers in Tree- Rooted and Binary Trees | **12** |
| II | **CONNECTIVITY AND PLANARITY:** Introduction to circuits - cut set- properties of cut set- All cut sets –connectivity and separability – Network Flows - 1-Isomorphism - 2-Isomorphism- Combinatorial and Geometric graphs- Planar Graphs – Different representation of planar | **12** |

| | | |
|---|---|---|
| | graph. | |
| III | **COLORING AND DIRECTED GRAPH:** Basics of Colouring&Chromatic number – Chromatic partitioning – Graph Colouring – four colour Problem Chromatic polynomial - Matching – Covering - Directed graphs - Types of Directed Graphs – Diagraphs and binary relations – Directed paths- Euler Graph. | **12** |
| IV | **MATRIX REPRESENTATION IN GRAPH:** Matrix representation of graphs, Sub graphs& Quotient Graphs, Transitive Closure digraph, Euler's Path & Circuit (only definitions and examples), spanning Trees of Connected Relations, Prim's Algorithm to construct Spanning Trees, Weighted Graphs, Minimal, Spanning Trees by Prim's Algorithm &Kruskal's Algorithm. | **12** |
| V | **APPLICATIONS OF GRAPH:** Traveling Sales Person Problem with Directed and Un directed Graph, - Graph with n vertices and k colours- Shortest path from one to many Cities with directed graph- Shortest Paths with Un directed Graphs-Connected Components. | **12** |
| **Total hours** | | **60** |

| **Course Outcomes** | | **Programme Outcomes** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | To Introduce the fundamental concepts in graph theory Graphs, subgraphs, walks, Euler graphs, Hamiltonian Paths Tree Properties , Hamiltonian paths and circuits | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO2 | Understanding the concepts of Circuits, Cut set and its Properties, Network Flows, Isomorphism and Combinatorial and Planar Graphs. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO3 | Applying the concept of Colouring with Chromatic Number, Directed Graphs, Matching , Covering Pattern and Euler Graphs | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO4 | Analysing the Various Concepts of Representation of Graphs, Euler Paths Circuit, Kruskals and Prims Algorithms, Connected Components. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO5 | Implementation of an application using All Types of Graphs and evaluate the Applications with travelling sales person Problem, K | PO1, PO2, PO3, PO4, |

| | | |
|---|---|---|
| | colour Problem with n vertices in a Graph and Shortest Path finding Problem using Directed and Undirected Graphs | PO5, PO6 |
| **Textbooks** | | |
| 1 | NarsinghDeo , " Graph Theory with Application to Engineering and Computer Science" Prentice Hall of India 2010(Reprint ) | |
| 2 | Rosen H "Discrete Mathematics and Its Application " McGraw Hill , 2007 | |
| **Reference Books** | | |
| 1. | Discrete Maths for Computer Scientists & Mathematicians by Mott, Kandel, Baker | |
| 2. | Clark J and Holton DA " First look at Graph Theory" AlliedPublishers 1995 | |
| 3. | Discrete Maths for Computer Scientists & Mathematicians by Mott, Kandel, Baker | |
| **Web Resources** | | |
| 1. | Web resources from NDL Library, E-content from open-source libraries | |

| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Marks** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | **CIA** | **External** | **Total** |
| **EC-GS** | Resource Management Techniques | **Elect** | 4 | - | - | | 3 | 25 | 75 | 100 |
| **Learning Objectives** | | | | | | | | | | |
| **LO1** | To introduce the concepts of OR | | | | | | | | | |
| **LO2** | To explain the Linear Programming Problem | | | | | | | | | |
| **LO3** | To illustrate the Simplex Method | | | | | | | | | |
| **LO4** | To know the Duality Theorems | | | | | | | | | |
| **LO5** | To understanding the Methods for finding IBFS for the Transportation Problems | | | | | | | | | |
| **UNIT** | **Contents** | | | | | | | | | **No. Of. Hours** |
| I | Development of OR: Definition of OR – Modeling - Characteristics and Phases - Tools, Techniques & Methods - scope of OR. | | | | | | | | | **12** |

| | | |
|---|---|---|
| II | Linear Programming Problem: Formulation - Slack & surplus variables - Graphical solution of LPP. | **12** |
| III | Simplex Method: Computational Procedure - Big-M method - Concept of duality in LPP - Definition of primal dual problems - General rules for converting any primal into its dual. | **12** |
| IV | Duality Theorems: (without proof) Primal dual correspondence - Duality and Simplex method - Mathematical formulation of assignment problem - Method for solving assignment problem. | **12** |
| V | Mathematical formulation of Transportation Problem: Methods for finding IBFS for the Transportation Problems. | **12** |
| **Total hours** | | **60** |

| **Course Outcomes** | | **Programme Outcomes** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | To understanding the concepts of Development of OR | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO2 | develop linear programming (LP) models for shortest path, maximum flow, minimal spanning tree, critical path, minimum cost flow, and transshipment problems | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO3 | Solve the problems of Simplex Method | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO4 | To study the Duality Theorems | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO5 | Finding initial basic feasible and optimal solution of the Transportation problems | PO1, PO2, PO3, PO4, PO5, PO6 |

**Textbooks**

| | |
|---|---|
| 1 | Operations Research, S.D.Sharma, KedarNath Ram Nath& Co<br>Unit I : Chapter-1(1.1, 1.2, 1.4,1.,1.8,1.9,1.10,1.11)<br>Unit II : Chapter-3 (3.1, 3.2, 3.3, 3.3.1, 3.3.2, 3.3.3, 3.3.4, 3.4,3.5)<br>Unit III : Chapter-5 (5.1, 5.2, 5.2.1, 5.3,5.4,5.5.4)<br>Chapter- 7 (7.1,7.2,7.3,7.4)<br>Unit IV : Chapter-7 (7.5) (Statements only); 7.6, 7.7 |

| | |
|---|---|
| | Chapter 11(11.2,11.3,11.4)<br>Unit V : Chapter-12 (12.2 to 12.8) |
| **Reference Books** | |
| 1. | Operation Research, Nita H.Shah, Ravi M.Gor and Hardiksoni,PrenticeHall of India Pvt. Ltd., New Delhi 2008. |
| 2. | Operation Research, R.Sivarethinamohan, Tata McGraw Hill, 2005. |
| 3. | Operations Research – An Introduction by HamdyA.Taha. Ninth Edition, Dorling Kindersley Pvt. Ltd., Noida, India, 2012 |
| **Web Resources** | |
| 1. | Web resources from NDL Library, E-content from open-source libraries |

## Annexure I

# Suggested Topics in Elective courses (EC1-EC8)

# Discipline Specific Electives Syllabus

1. Natural Language Processing
2. Analytics for Service Industry
3. Cryptography
4. RDBMS with PL/SQL
5. Big Data Analytics
6. IOT and its Applications
7. Software Project Management
8. Image Processing
9. Human Computer Interaction
10. Fuzzy Logic
11. Artificial Intelligence
12. Robotics and its Applications
13. Computational Intelligence
14. Cloud Computing
15. Artificial Neural Network
16. Introduction to Data Science
17. Agile Project Management
18. Virtual Reality and more

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CIA | External | Total |
| EC-DS | 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 | **12** |

| | | |
|---|---|---|
| | Indian Languages. | |
| 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** |
| **Total hours** | | **60** |
| **Course Outcomes** | | **Programme Outcomes** |
| CO | On completion of this course, students will | |
| CO1 | Describe the fundamental concepts and techniques of natural language processing.<br>Explain the advantages and disadvantages of different NLP technologies and their applicability in different business situations. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO2 | Distinguish among the various techniques, taking into account the assumptions, strengths, and weaknesses of each<br>Use NLP technologies to explore and gain a broad understanding oftext data. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO3 | Use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions.<br>Use NLP methods to analyse sentiment of a text document. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO4 | Analyze large volume text data generated from a range of real-world applications.<br>Use NLP methods to perform topic modelling. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO5 | Develop robotic process automation to manage business processes and to increase and monitor their efficiency and effectiveness.<br>Determine the framework in which artificial intelligence and the Internet of things may function, including interactions with people, enterprise functions, and environments. | PO1, PO2, PO3, PO4, PO5, PO6 |

| | | |
|---|---|---|
| **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 |
| **WeightageofcoursecontributedtoeachPSO** | 14 | 14 | 15 | 15 | 13 | 15 |

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CIA | External | Total |
| EC-DS | ANALYTICSFOR SERVICE INDUSTRY | 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 | **PerformanceAnalysis:** 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** | | **Programme Outcomes** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Understand and critically apply the concepts and methods of business analytics | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO2 | Identify, model and solve decision problems in different settings. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO3 | Interpret results/solutions and identify appropriate courses of action for a given managerial situation whether a problem or an opportunity. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO4 | Create viable solutions to decision making problems. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO5 | Instill a sense of ethical decision-making and a commitment to the long-run welfare of both organizations and the communities they serve. | PO1, PO2, PO3, PO4, PO5, PO6 |

| **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 |
| **WeightageofcoursecontributedtoeachPSO** | 14 | 15 | 14 | 15 | 15 | 14 |

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

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CIA | External | Total |
| **EC-DS** | **CRYPTOGRAPHY** | **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**: SecureSocketLayerand 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**, "*Network Security*", 2011, First Edition,USP. |
| | **Web Resources** |
| 1 | https://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 |
| **WeightageofcoursecontributedtoeachPSO** | 14 | 13 | 15 | 12 | 14 | 14 |

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 |
| **EC-DS** | **Relational Database Management System with PL/SQL** | Elective | 4 | - | - | - | 3 | 4 | 25 | 75 | 100 |

| **Course Objective** | |
|---|---|
| LO1 | To understand the basic DBMS models and architecture |
| LO2 | To learn how to query and normalize the database. |
| LO3 | To study the data base design, transaction Processing and Management and Security Issues. |
| LO4 | To understanding the concepts of Functional Dependencies |
| LO5 | To understanding the concepts of PL/SQL. |

| UNIT | Contents | No. of Hours | Course Objective |
|---|---|---|---|
| I | Introduction to Databases: Introduction – | 12 | |

| | | |
|---|---|---|
| | Characteristics of the Database Approach – Actors on the Scene – Workers behind the scene – Advantages of using DBMS Approach. Overview of database and Architectures: Data Models, Schemas, and Instances – Three-schema Architecture and Data Independence – Database languages & Interfaces – Database System Environment– Centralized & Client Server Architecture for DBMS - Classification of DBMS. | |
| II | Basic Relational Model: Relational Model Concepts – Relational Model Constraints and Relational Database Schemas – Update Operations, Tractions, Dealing with Constraint Violations – Formal Relational Languages: Unary Relational Operations: SELECT and PROJECT – Relational Algebra Operations from Set Theory – Binary Relational Operations: JOIN and DIVISION – Examples of Queries in Relational Algebra. | 12 |
| III | Conceptual Data Modeling using the ER Model: Using High-Level Conceptual Data Models for Database Design – An example DB application – Entity Types, Entity Sets, Attributes, and Keys – Relationship Types, Relationship sets, Roles, and Structural Constraints – Weak entity types – Example- Mapping a Conceptual Design into Logical Design: Relational Database Design using ER- Relational Mapping – Mapping EER Model Constructs to Relations | 12 |

| | | |
|---|---|---|
| IV | Functional Dependencies and Normalization for Relational Database: Functional Dependencies – Definition of Functional Dependency – Normal Forms based on Primary Keys – Normalization of Relations – First Normal Form – Second Normal Form – Third Normal Form – BCNF- Fourth Normal Form- Fifth Normal Form. | 12 |
| V | SQL: The Relational Database Standard: Data definition, Constraints, and schema changes in SQL – Basic Queries in SQL – More complex SQL Queries – Insert, delete and update statements in SQL – Views in SQL.<br><br>PL/SQL: Introduction to PL/SQL – More on PL/SQL – Error Handling in PL/SQL – Oracle‘s Named Exception Handlers – Stored Procedures and Functions – Execution of Procedures and Functions – Advantages – Procedures Vs. Functions – Syntax for Creating Procedures and Functions – Deleting a Stored Procedure or Function – Oracle Packages – Database Triggers – Types Of Triggers – Deleting a Trigger – Raise-Application Error Procedure | 12 |
| | **Total** | **60** |

| **Course Outcomes** | | **Programme Outcomes** |
|---|---|---|
| CO | On completion of this course, students will | |
| 1 | Outline the fundamental RDBMS concepts and PL/SQL | PO1 |
| 2 | Apply database operations, mapping, normalization, SQL and PL/SQL | PO1, PO2 |
| 3 | Analyze the requirements to implement relational database concepts | PO4, PO5 |

| | | |
|---|---|---|
| 4 | Evaluate the database based on various models and normalization. | PO3, PO5, PO6 |
| 5 | Design and construct normalized tables and manipulate it effectively using SQL and PL/SQL database objects | PO3, PO4 |
| **Text Book** | | |
| 1 | RamezElmasri, Shamkant B. Navathe (2014), ―Database Systems‖, Sixth edition, Pearson Education, New Delhi. | |
| 2 | Ivan Bayross (2003 Reprint), SQL, PL/SQL-The Programming Language of Oracle, Second Revised Edition, BPB Publications, New Delhi. | |
| | | |
| | **Reference Book** | |
| 1. | Abraham Silberschatz, Henry F.Korth, S.Sudarshan, Database System Concepts, Tata McGraw Hill Publication, 4th Edition. | |
| **Web Resources** | | |
| 1. | http://srikanthtechnologies.com/books/orabook/ch1.pdf | |
| 2. | Http://www.tmv.edu.in/pdf/Distance_education/BCA%20Books/BCA%20IV%20SEM/BC A-428%20Oracle.pdf | |
| 3. | http://www.tutorialspoint.com/sql/sql-rdbms-concepts.htm | |
| 4. | http://ecomputernotes.com/database-system/rdbms | |
| 5. | http://www.mithunashok.com/2011/04/basics-of-rdbms.html | |

| Subject Code | Subject | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| **EC-DS** | **Big Data Analytics** | Elective | 4 | - | - | - | 3 | 4 | 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 | Contents | No. of Hours | Course Objective |
|---|---|---|---|
| I | **Data Explosion and Big Data Analytics**: An Overview: Introduction, Evolution of Database Technology and Big Data, Elements of Big Data, Big Data System Components, Big Data Analytics – Data Analytics. Types of Big Data Analytics, Applications of Big Data Technology, Challenges and Skills required with Big Data Technology. | 12 | |
| II | **Analytical Theory:** Introduction about Classification Algorithms, Regression Techniques, Domain Specific Analytic Techniques: In Database Analytics, Text Analytics.<br><br>**Real – Time Analysis:** Introduction: Real-time System, Types of Real-time System, Characteristics of Real-time Systems, Real-time Processing Systems for Big Data: Introduction, Data Integration and Analytics, Big Data Engine-Hadoop, Real-time System Architecture, Real-time Data Analytics. | 12 | |
| III | **Big Data: Hardware, Technology Foundations**: Introduction, Big Data Stack, Virtualization and Big Data. | 12 | |

| | | |
|---|---|---|
| | **Understanding NoSQL and Hadoop Ecosystem**: Introduction, NoSQL: CouchDB, MongoDB, Hadoop Ecosystem – HDFS, HBase, Yarn. | |
| IV | **High Dimensional Data: A Big Data Perspective:** Introduction – What is Dimensionality? Dimensionality Reduction: Approaches for Dimensionality Reduction, Dimensionality Reduction Techniques.<br><br>**User Interface and Visualization:** Desirable Properties, Visualization Techniques.<br><br>**R Programming Basics:** Introduction, Data Types, Data Structures and Operators – Basic Data Types in R, R Operators, Vectors, List, Factor, Arrays and Matrix, Data Frame, R Programming Structure – Control Statements of R: if, if-else, if-else ladder, Switch-Case, Return, Loops and Loop Control Statements. | 12 |
| V | Interfacing R - Interfacing R to other languages – Parallel R–Basic Statistic s– Linear Model– Generalized Linear models–Non-linear Models– Time Series and Auto-Correlation– Clustering. | 12 |
| | **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, PO5 |
| 4 | Perform analytics on data streams. | PO3, PO5, PO6 |
| 5 | Learn NoSQL databases and management. | PO3, PO4 |

**Text Book**


1 **1.** Big Data Analytics – Concepts, Techniques, Tools and Technologies – First Edition, Dr.M.Thangaraj,Dr. S. Suguna, G. Sudha, PHI Learning Private

| | |
|---|---|
| | Limited, Delhi,2022.<br><br>**Unit I : Chapter 1**<br>**Unit II : Chapter 2.2.2, 2.2.4, 2.3.2, 2.3.2**<br>**Chapter 3 (3.1.1, 3.1.2, 3.2, 3.3.1 – 3.3.4, 3.4)**<br>**Unit III : Chapter 4 (4.1 – 4.3)**<br>**Chapter 5 (5.1, 5.2, 5.3.1 - 5.3.3)**<br>**Unit IV : Chapter 6.1, 6.3**<br>**Chapter 7.3**<br>**Chapter 8 (8.1 – 8.3)**<br>**Unit V : Chapter 8 (8.4 – 8.7)** |
| **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 |
|---|---|---|---|---|---|---|
| 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 ofcoursecontributedtoeachPSO | 15 | 14 | 11 | 15 | 15 | 13 |

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 |
| **EC-DS** | **Internet of Things and its applications** | Elective | 4 | - | - | - | 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** | | | |
| 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 | | | |
| 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 | | | |
| 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, | | | | | | | 12 | | | |

| | | |
|---|---|---|
| | Functional View, Information View, Deployment and Operational View, Other Relevant architectural views | |
| 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 |
| 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 |
| | **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, PO5 |

**Text Book**

| | |
|---|---|
| 1 | Vijay Madisetti and ArshdeepBahga, "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:**

| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 3 | 2 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 2 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 2 | 3 | 3 | 2 |
| Weightage ofcoursecontributedtoeachPSO | 15 | 12 | 11 | 15 | 15 | 14 |

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 |
| EC-DS | SOFTWARE PROJECT MANAGEMENT | Elective | 4 | - | - | - | 3 | 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** | To famialarize in Software Project planning | |
| **LO4** | 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** | | |
| 1 | Robert T. Futrell, Donald F. Shafer, Linda I. Safer, “Quality Software Project | |

| | |
|---|---|
| | Management", Pearson Education Asia 2002. |
| **Reference Books** | |
| 1. | PankajJalote, "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. | Software Project Management e-resources from Digital libraries |
| 2. | www.smartworld.com/notes/software-project-management |

**Mapping with Programme Outcomes:**

| **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** |
| **Weightageofcoursecontributed toeachPSO** | **13** | **11** | **10** | **13** | **13** | **12** |

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 |
| **EC-DS** | **Image Processing** | Elective | 4 | - | - | - | 3 | 4 | 25 | 75 | 100 |

| **Learning Objective** | |
|---|---|
| LO1 | To learn fundamentals of digital image processing. |
| LO2 | To learn about various 2D Image transformations |
| LO3 | To learn about various image enhancement processing methods and filters |
| LO4 | To learn about various classification of Image segmentation techniques |
| LO5 | To learn about various image compression techniques |

| UNIT | Contents | No. of Hours |
|---|---|---|
| I | **Digital Image Fundamentals:** Image representation - Basic relationship between pixels, Elements of DIP system -Applications of Digital Image Processing - 2D Systems - Classification of 2D Systems - Mathematical Morphology- Structuring Elements- Morphological Image Processing - 2D Convolution - 2D Convolution Through Graphical Method -2D Convolution Through Matrix Analysis | 12 |
| II | 2D Image transforms: Properties of 2D-DFT - Walsh transform - Hadamard transform- Haar transform- Discrete Cosine Transform- Karhunen-Loeve Transform -Singular Value Decomposition | 12 |
| III | Image Enhancement: Spatial domain methods- Point processing- Intensity transformations - Histogram processing- Spatial filtering- smoothing filter- Sharpening filters - Frequency domain methods: low pass filtering, high pass Filtering- Homomorphic filter. | 12 |
| IV | Image segmentation: Classification of Image segmentation techniques - Region approach – Clustering techniques - Segmentation based on thresholding - Edge based segmentation - Classification of edges- Edgedetection - Hough transform- Active contour. | 12 |
| V | Image Compression: Need for compression -Redundancy- Classification of image- Compression schemes- Huffman coding- Arithmetic coding- Dictionary based compression -Transform based compression, | 12 |

| | Total | 60 |
|---|---|---|
| **Course Outcomes** | | **Programme Outcome** |
| CO | On completion of this course, students will | |
| 1 | Understand the fundamental concepts of digital image processing. | PO1 |
| 2 | Understand various 2D Image transformations | PO1, PO2 |
| 3 | Understand image enhancement processing techniques and filters | PO4, PO6 |
| 4 | Understand the classification of Image segmentation techniques | PO4, PO5, PO6 |
| 5 | Understand various image compression techniques | PO3, PO5 |
| **Text Book** | | |
| 1 | S Jayaraman, S Esakkirajan, T Veerakumar, Digital image processing ,Tata McGraw Hill, 2015 | |
| 2 | Gonzalez Rafel C, Digital Image Processing, Pearson Education, 2009 | |
| **Reference Books** | | |
| 1. | 1. Jain Anil K , Fundamentals of digital image processing: , PHI,1988 | |
| 2. | Kenneth R Castleman , Digital image processing:, Pearson Education,2/e,2003 | |
| 3. | Pratt William K , Digital Image Processing: , John Wiley,4/e,2007 | |
| **Web Resources** | | |
| 1. | https://kanchiuniv.ac.in/coursematerials/Digital%20image%20processing%20-Vijaya%20Raghavan.pdf | |
| 2. | http://sdeuoc.ac.in/sites/default/files/sde_videos/Digital%20Image%20Processing%203rd%20ed.%20-%20R.%20Gonzalez%2C%20R.%20Woods-ilovepdf-compressed.pdf | |
| 3. | https://dl.acm.org/doi/10.5555/559707 | |
| 4. | https://www.ijert.org/image-processing-using-web-2-0-2 | |

**Mapping with Programme Outcomes:**

| 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 ofcoursecontributedtoeachPSO** | **15** | **14** | **11** | **15** | **10** | **10** |

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 |
| **EC-DS** | **Human Computer Interaction** | Elective | 4 | - | - | - | 3 | 4 | 25 | 75 | 100 |
| **Learning Objectives** | | | | | | | | | | | |
| LO1 | To learn about the foundations of Human Computer Interaction. | | | | | | | | | | |
| LO2 | To learn the design and software process technologies. | | | | | | | | | | |
| LO3 | To learn HCI models and theories. | | | | | | | | | | |
| LO4 | To learn Mobile Ecosystem. | | | | | | | | | | |
| LO5 | To learn the various types of Web Interface Design. | | | | | | | | | | |
| | | | | | | | | | | | |
| **UNIT** | **Contents** | | | | | | | | | | **No. of Hours** |
| I | **FOUNDATIONS OF HCI :**<br>• The Human: I/O channels – Memory<br>• Reasoning and problem solving; The Computer: Devices – Memory – processing and networks;<br>• Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies | | | | | | | | | | 12 |
| II | **DESIGN & SOFTWARE PROCESS:**<br>• Interactive Design:<br>• Basics – process – scenarios<br>• Navigation: screen design Iteration and prototyping.<br>• HCI in software process:<br>• 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:**<br>• HCI Models : Cognitive models:- Socio-Organizational issues and stakeholder requirements Communication and collaboration models-Hypertext, Multimedia and WWW. | 12 |
| IV | **Mobile HCI:**<br>• Mobile Ecosystem: Platforms, Application frameworks<br>• Types of Mobile Applications: Widgets, Applications, Games<br>• Mobile Information Architecture, Mobile 2.0,<br>• 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 | |
| CO1 | Understand thefundementals of HCI. | PO1 |
| CO2 | Understand the design and software process technologies. | PO1, PO2 |
| CO3 | Understand HCI models and theories. | PO4, PO6 |
| CO4 | Understand Mobile Ecosystem, types of Mobile Applications, mobile Architecture and design. | PO4, PO5, PO5 |
| CO5 | Understand the various types of Web Interface Design. | PO3, PO4 |

**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:**

| 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 ofcoursecontributedtoeachPSO | 15 | 14 | 11 | 15 | 11 | 10 |

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 |
| EC-DS | **Fuzzy Logic** | Elective | 4 | - | - | - | 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 | Contents | No. of Hours |
|---|---|---|
| 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 |
| 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 |
| III | Membership Functions: Introduction, Features of Membership Function, Classification of Fuzzy Sets, Fuzzification, Membership Value Assignments, Intuition, Inference, Rank Ordering. | 12 |
| IV | Defuzzification: Introduction, Lambda Cuts for Fuzzy Sets, Lambda Cuts for Fuzzy Relations, DefuzzificationMethods, Fuzzy Rule-Based System: Introduction, Formation of Rules, Decomposition of Rules, Aggregation of Fuzzy Rules, Properties of Set of Rules. | 12 |
| 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 |
| | **Total** | **60** |

| **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. | PO3, PO4, PO6 |
| 5 | Design an application using Fuzzy logic and its Relations. | PO3, PO6 |
| **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:**

| 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** | **2** | **3** | **2** |
| **Weightage ofcoursecontributedtoeachPSO** | **15** | **14** | **11** | **14** | **11** | **10** |

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| **EC-DS** | **Artificial Intelligence** | Elective | 4 | - | - | - | 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** | **Contents** | **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, PO4 |
| **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. | SarojKaushik, "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. | https://github.com/dair-ai/ML-Course-Notes | |
| 2. | https://web.cs.hacettepe.edu.tr/~erkut/ain311.f21/index.html | |
| 3. | https://www.toolify.ai/?gclid=CjwKCAjwvdajBhBEEiwAeMh1U6tlqU1LXlRFbcghLMZVwICm_4PkIRcDRE-VYq_wTDcuaQeq_bCHnhoCcm4QAvD_BwE | |

**Mapping with Programme Outcomes:**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **1** | **2** | **1** | **2** |
| **CO2** | **3** | **3** | **2** | **2** | **3** | **3** |
| **CO3** | **3** | **3** | **2** | **3** | **3** | **2** |
| **CO4** | **3** | **2** | **3** | **2** | **2** | **3** |
| **CO5** | **3** | **2** | **2** | **2** | **3** | **3** |
| **Weightage ofcoursecontributedto eachPSO** | **15** | **12** | **10** | **11** | **12** | **13** |

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 |
| **EC-DS** | **Robotics and its Applications** | Elective | 4 | - | - | - | 3 | 4 | 25 | 75 | 100 |
| **Learning Objectives** | | | | | | | | | | | |
| LO1 | To understand the robotics fundamentals | | | | | | | | | | |
| LO2 | Understand the sensors and matrix methods | | | | | | | | | | |
| LO3 | Understand the Localization: Self-localizations and mapping | | | | | | | | | | |
| LO4 | To study about the concept of Path Planning, Vision system | | | | | | | | | | |
| LO5 | 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 | |
| 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<br>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 | |
| III | Localization: Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems. | 12 | |
| IV | Path Planning: Introduction, path planning-overview-road map path planning-cell decomposition path | 12 | |

| | | |
|---|---|---|
| | planning potential field path planning-obstacle avoidance-case studies<br>Vision system: Robotic vision systems-image representation-object recognition-and categorization-depth measurement- image data compression-visual inspection-software considerations | |
| 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 |
| | **Total** | **60** |

| **Course Outcomes** | | **Programme Outcomes** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Describe the different physical forms of robot architectures. | PO1 |
| CO2 | Kinematically model simple manipulator and mobile robots. | PO1, PO2 |
| CO3 | Mathematically describe a kinematic robot system | PO4, PO6 |
| CO4 | Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty. | PO4, PO5, PO6 |
| CO5 | 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:**

| 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 ofcoursecontributedtoeachPSO | 15 | 14 | 11 | 15 | 15 | 10 |

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 |
| EC-DS | **Computational Intelligence** | Elective | 4 | - | - | - | 3 | 4 | 25 | 75 | 100 |

| Learning Objectives | |
|---|---|
| LO1 | To identify and understand the basics of AI and its search. |
| LO2 | To study about the Fuzzy logic systems. |
| LO3 | Understand and apply the concepts of Neural Network and its functions. |
| LO4 | Understand the concepts of Artifical Neural Network |
| LO5 | To study about the Genetic Algorithm. |

| UNIT | Contents | No. of Hours |
|---|---|---|
| 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 | 12 |

| | | |
|---|---|---|
| | Climbing. | |
| II | **Fuzzy Logic Systems:**<br><br>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 |
| 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 |
| IV | **Artificial Neural Networks:** Fundamental Concepts – Basic Models of Artificial Neural Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron – Linear Separability – Hebb Network. | 12 |
| 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 |
| | **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 | PO4, PO5, PO6 |

| | | |
|---|---|---|
| | applications. | |
| 5 | Understand the concept of Genetic Algorithm and Analyze the optimization problems using GAs. | PO3, PO5 |
| **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, Mcneill, 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:**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 2 | 1 | 2 |
| CO2 | 3 | 3 | 2 | 2 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 2 | 2 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 3 | 3 |
| Weightage ofcoursecontributedto eachPSO | 15 | 12 | 10 | 11 | 12 | 13 |

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| **EC-DS** | **Grid Computing** | Elective | 4 | - | - | - | 3 | 4 | 25 | 75 | 100 |

| **Course Objective** | |
|---|---|
| LO1 | To learn the basic construction and application of Grid computing. |
| LO2 | To learn grid computing organization and their Role. |
| LO3 | To learn Grid Computing Anotomy. |
| LO4 | To learn Grid Computing road map. |
| LO5 | To learn various type of Grid Architecture. |

| **UNIT** | **Contents** | **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 | |
| CO1 | To understand the basic elements and concepts of Grid computing. | PO1 |

| | | |
|---|---|---|
| CO2 | To understand the Grid computing toolkits and Framework. | PO1, PO2 |
| CO3 | To understand the concepts of Anotomy of Grid Computing. | PO4, PO6 |
| CO4 | To understand the concept of service oriented architecture. | PO4, PO5 |
| CO5 | To Gain knowledge on grid and web service architecture. | PO3, PO5 |
| **Text Book** | | |
| 1 | Joshy Joseph and Craig Fellenstein, Grid computing, Pearson / IBM Press, PTR, 2004. | |
| **Reference Books** | | |
| 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:**

| 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 ofcoursecontributedtoeachPSO** | **15** | **14** | **11** | **15** | **10** | **10** |

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 |
| **EC-DS** | **Cloud Computing** | Elective | 4 | - | - | - | 3 | 4 | 25 | 75 | 100 |

| Course Objective | | |
|---|---|---|
| LO1 | Learning fundamental concepts and Technologies of Cloud Computing. | |
| LO2 | Learning various cloud service types and their uses and pitfalls. | |
| LO3 | To learn about Cloud Architecture and Application design. | |
| LO4 | To know the various aspects of application design, benchmarking and security on the Cloud. | |
| LO5 | To learn the various Case Studies in Cloud Computing. | |
| **UNIT** | **Contents** | **No. of Hours** |
| I | Introduction to Cloud Computing: Definition of Cloud Computing – Characteristics of Cloud Computing – Cloud Models – Cloud Service Examples – Cloud-based Services and Applications.<br><br>Cloud Concepts and Technologies: Virtualization – Load balancing – Scalability and Elasticity – Deployment – Replication – Monitoring – Software Defined Networking – Network Function Virtualization – MapReduce – Identity and Access Management – Service Level Agreements – Billing. | 12 |
| II | Cloud Services<br>Compute Services: Amazon Elastic Computer Cloud - Google Compute Engine - Windows Azure Virtual Machines<br>Storage Services: Amazon Simple Storage Service - Google Cloud Storage - Windows Azure Storage<br>Database Services: Amazon Relational Data Store - Amazon Dynamo DB - Google Cloud SQL - Google Cloud Data Store - Windows Azure SQL Database - Windows Azure Table Service<br>Application Services: Application Runtimes and Frameworks - Queuing Services - Email Services - Notifiction Services - Media Services<br>Content Delivery Services: Amazon CloudFront - Windows Azure Content Delivery Network<br>Analytics Services: Amazon Elastic MapReduce - Google | 12 |

| | | |
|---|---|---|
| | MapReduceService - Google BigQuery - Windows Azure HDInsight<br>Deployment and Management Services: Amazon Elastic Beanstack - Amazon CloudFormation<br>Identity and Access Management Services: Amazon Identiy and Access Management - Windows Azure Active Directory<br>Open Source Private Cloud Software: CloudStack – Eucalyptus - OpenStack | |
| III | **Cloud Application Design:** Introduction – Design Consideration for Cloud Applications – Scalability – Reliability and Availability – Security – Maintenance and Upgradation – Performance – Reference Architectures for Cloud Applications – Cloud Application Design Methodologies: Service Oriented Architecture (SOA), Cloud Component Model, IaaS, PaaS and SaaS Services for Cloud Applications, Model View Controller (MVC), RESTful Web Services – Data Storage Approaches: RelationalApproach (SQL), Non-RelationalApproach (NoSQL). | 12 |
| IV | **Cloud Application Benchmarking and Tuning:** Introduction to Benchmarking – Steps in Benchmarking – WorkloadCharacteristics – Application Performance Metrics – Design Consideration for BenchmarkingMethodology – Benchmarking Tools and Types of Tests – DeploymentPrototyping.<br>**Cloud Security:** Introduction – CSA Cloud Security Architecture – Authentication (SSO) – Authorization – Identity and Access Management – Data Security : Securing data atrest, securing data in motion – Key Management – Auditing. | 12 |
| V | **Case Studies:** Cloud Computing for Healthcare – Cloud Computing for EnergySystems - Cloud Computing for Transportation Systems - Cloud Computing for ManufacturingIndustry - Cloud Computing for Education. | 12 |
| | **Total** | **60** |

| Course Outcomes | | Programme Outcome |
|---|---|---|
| CO | On completion of this course, students will | |
| CO 1 | Understand the fundamental concepts and Technologies in Cloud Computing. | PO1 |
| CO 2 | Able to understand various cloud service types and their uses and pitfalls. | PO1, PO2 |
| CO 3 | Able to understand Cloud Architecture and Application design. | PO4, PO5 |
| CO 4 | Understand the various aspects of application design, benchmarking and security in the Cloud. | PO4, PO5, PO6 |
| CO 5 | Understand various Case Studies in Cloud Computing. | PO3, PO6 |
| **Text Book** | | |
| 1 | ArshdeepBahga, Vijay Madisetti, *Cloud Computing – A Hands On Approach*, Universities Press (India) Pvt. Ltd., 2018 | |
| **Reference Books** | | |
| 1. | Anthony T Velte, Toby J Velte, Robert Elsenpeter, *Cloud Computing: A Practical Approach*, Tata McGraw-Hill, 2013. | |
| 2. | Barrie Sosinsky, *Cloud Computing Bible*, Wiley India Pvt. Ltd., 2013. | |
| 3. | David Crookes, *Cloud Computing in Easy Steps*, Tata McGraw Hill, 2015. | |
| 4. | Dr. Kumar Saurabh, *Cloud Computing*, Wiley India, Second Edition 2012. | |
| **Web Resources** | | |
| 1. | https://en.wikipedia.org/wiki/Cloud_computing | |
| 2. | https://link.springer.com/chapter/10.1007/978-3-030-34957-8_7 | |
| 3. | https://webobjects.cdw.com/webobjects/media/pdf/solutions/cloud-computing/121838-CDW-Cloud-Computing-Reference-Guide.pdf | |

**Mapping with Programme Outcomes:**

| 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 ofcoursecontributedtoeachPSO** | **15** | **14** | **11** | **15** | **15** | **10** |

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** |
| **EC-DS** | **Artificial Neural Networks** | Elective | 4 | - | - | - | 3 | 4 | 25 | 75 | 100 |

| **Learning Objectives** | |
|---|---|
| LO1 | **Understand the basics of artificial neural networks, learning process, single layer and multi-layer perceptron networks.** |
| LO2 | Understand the Error Correction and various learning algorithms and tasks. |
| LO3 | Identify the various Single Layer Perception Learning Algorithm. |
| LO4 | Identify the various Multi-Layer Perception Network. |
| LO5 | Analyze the Deep Learning of various Neural network and its Applications. |

| **UNIT** | **Contents** | **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. | 12 |

| | | |
|---|---|---|
| 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 | |
| CO1 | **Students will learn the basics of artificial neural networks with single layer and multi-layer perception networks.** | PO1 |
| CO2 | Learn about the Error Correction and various learning algorithms and tasks. | PO1, PO2 |
| CO3 | Learn the various Perception Learning Algorithm. | PO4, PO5 |
| CO4 | Learn about the various Multi-Layer Perception Network. | PO4, PO5, PO6 |
| CO5 | Understand the Deep Learning of various Neural network and its Applications. | PO3, PO5 |

| **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:**

| 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** | **2** | **3** | **2** | **3** | **2** | **2** |
| **Weightage ofcoursecontributedtoeach PSO** | **14** | **14** | **11** | **15** | **10** | **10** |

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 |
| **EC-DS** | **Introduction to Data Science** | Elective | 4 | - | - | - | 3 | 4 | 25 | 75 | 100 |
| **Learning Objectives** | | | | | | | | | | | |
| LO1 | To learn about basics of Data Science and Big data. | | | | | | | | | | |
| LO2 | To learn about overview and building process of Data Science. | | | | | | | | | | |
| LO3 | To learn about various Algorithms in Data Science. | | | | | | | | | | |
| LO4 | To learn about Hadoop Framework. | | | | | | | | | | |
| LO5 | To learn about case study about Data Science. | | | | | | | | | | |
| **UNIT** | **Contents** | | | | | | | | | | **No. of Hours** |
| I | **Introduction:** Benefits and uses – Facts of data – Data science process – | | | | | | | | | | 12 |

| | | |
|---|---|---|
| | Big data ecosystem and data science | |
| II | **The Data science process**:Overview – research goals - retrieving data - transformation – Exploratory Data Analysis – Model building . | 12 |
| III | **Algorithms** :Machine learning algorithms – Modeling process – Types – Supervised – Unsupervised - Semi-supervised | 12 |
| IV | **Introduction to Hadoop** :Hadoop framework – Spark – replacing MapReduce– NoSQL – ACID – CAP – BASE – types | 12 |
| V | **Case Study**: Prediction of Disease - Setting research goals - Data retrieval – preparation - exploration - Disease profiling - presentation and automation | 12 |
| | **Total** | **60** |

| **Course Outcomes** | | **Programme Outcome** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Understand the basics in Data Science and Big data. | PO1 |
| CO2 | Understand overview and building process in Data Science. | PO1, PO2 |
| CO3 | Understand various Algorithms in Data Science. | PO3, PO6 |
| CO4 | Understand Hadoop Framework in Data Science. | PO4, PO5 |
| CO5 | Case study in Data Science. | PO3, PO5 |

**Text Book**


| | |
|---|---|
| 1 | Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science", manning publications 2016 |


**Reference Books**


| | |
|---|---|
| 1. | Roger Peng, "The Art of Data Science", lulu.com 2016. |
| 2. | MurtazaHaider, "Getting Started with Data Science – Making Sense of Data with Analytics", IBM press, E-book. |
| 3. | Davy Cielen, Arno D.B. Meysman, Mohamed Ali,"Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools", Dreamtech Press 2016. |
| 4. | Annalyn Ng, Kenneth Soo, "Numsense! Data Science for the Layman: No Math Added", 2017,1st Edition. |

| | |
|---|---|
| 5. | Cathy O'Neil, Rachel Schutt, "Doing Data Science Straight Talk from the Frontline", O'Reilly Media 2013. |
| 6. | Lillian Pierson, "Data Science for Dummies", 2017 II Edition |
| **Web Resources** | |
| 1. | https://www.w3schools.com/datascience/ |
| 2. | https://en.wikipedia.org/wiki/Data_science |
| 3. | http://www.cmap.polytechnique.fr/~lepennec/en/post/references/refs/ |

**Mapping with Programme Outcomes:**

| 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 ofcoursecontributedtoeachPSO** | **15** | **14** | **11** | **15** | **11** | **10** |

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 |
| **EC-DS** | **Agile Project Management** | Elective | 4 | - | - | - | 3 | 4 | 25 | 75 | 100 |
| **Learning Objectives** | | | | | | | | | | | |
| LO1 | Learning of software design, software technologies and APIs. | | | | | | | | | | |
| LO2 | Detailed demonstration about Agile development and testing techniques. | | | | | | | | | | |
| LO3 | Learning about Agile Planning and Execution. | | | | | | | | | | |
| LO4 | Understanding of Agile Management Design and Quality Check. | | | | | | | | | | |

| LO5 | Detailed examination of Agile development and testing techniques. | |
|---|---|---|
| **UNIT** | **Contents** | **No. of Hours** |
| I | **Introduction:Modernizing Project Management:** Project Management Needed a Makeover – Introducing Agile Project Management.<br>**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.<br>**Why Being Agile Works Better:** Evaluating Agile benefits – How Agile approaches beat historical approaches – Why people like being Agile. | 12 |
| II | **Being Agile**<br>**Agile Approaches:** Diving under the umbrella of Agile approaches – Reviewing the Big Three: Lean, Scrum, Extreme Programming - Summary<br>**Agile Environments in Action:** Creating the physical environment – Low-tech communicating – High-tech communicating – Choosing tools.<br>**Agile Behaviours in Action:** Establishing Agile roles – Establishing new values – Changing team philosophy. | 12 |
| III | **Agile Planning and Execution**<br>**Defining the Product Vision and Roadmap:** Agile planning – Defining the product vision – Creating a product roadmap – Completing the product backlog.<br>**Planning Releases and Sprints:** Refining requirements and estimates – Release planning – Sprint planning.<br>**Working Throughout the Day:** Planning your day – Tracking progress | 12 |

| | | |
|---|---|---|
| | – Agile roles in the sprint – Creating shippable functionality – The end of the day.<br><br>**Showcasing Work, Inspecting and Adapting:** The sprint review – The sprint retrospective.<br><br>**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 | |
| IV | **Agile Management**<br><br>**Managing Scope and Procurement:** What's different about Agile scope management – Managing Agile scope – What's different about Agile procurement – Managing Agile procurement.<br><br>**Managing Time and Cost:** What's different about Agile time management – Managing Agile schedules – What's different about Agile cost management – Managing Agile budgets.<br><br>**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.<br><br>**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**<br><br>**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.<br><br>**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.<br><br>**Benefits, Factors for Success and Metrics:** Ten key benefits of Agile project management – Ten key factors for project success – Ten metrics | 12 |

| | | |
|---|---|---|
| | for Agile Organizations. | |
| | **Total** | **60** |

| **Course Outcomes** | | **Programme Outcome** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Understanding of software design, software technologies and APIs using Agile Management. | PO1 |
| CO2 | Understanding of Agile development and testing techniques. | PO1, PO2 |
| CO3 | Understanding about Agile Planning and Execution using Sprint. | PO4, PO5 |
| CO4 | Understanding of Agile Management Design, scope, Procurement, managing Time and Cost and Quality Check. | PO4, PO5, PO6 |
| CO5 | Analysing of Agile development and testing techniques. | PO2, PO4 |

| **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 |

**Mapping with Programme Outcomes:**

| 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 ofcoursecontributedtoeachPSO | 15 | 14 | 11 | 15 | 11 | 10 |

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

| Subject Code | Subject Name | L | T | P | S | Credits | Inst. Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CIA | External | Total |
| EC-DS | Virtual Reality | 4 | - | - | - | 3 | 4 | 25 | 75 | 100 |

**Learning Objectives**

| | |
|---|---|
| LO1 | To provide knowledge on basic principles of virtual & augmented reality |
| LO2 | To have the ability to use its technology as a platform for real-world applications. |

| Unit | Contents | No. of Hours |
|---|---|---|
| I | Virtual Reality: The Three I's of VR – History – Early commercial VR Technology – Components of a VR System –Input Devices: Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces | 12 |
| II | Output Devices: Graphics Displays – Sound Displays – Haptic Feedback - Computer Architecture for VR: The Rendering Pipeline- PC Graphics Architecture - VR Programming: Toolkits and Scene Graphs – Traditional and Emerging Applications of VR | 12 |
| III | Augmented Reality: Introduction – Augmented Reality Concepts: Working Principle of AR –Concepts related to AR- Ingredients of an Augmented Reality Experience | 12 |
| IV | Augmented Reality Hardware– Augmented Reality Software– Software to create content for AR Application – Tools and Technologies | 12 |
| V | Augmented Reality Content: Introduction- Creating Content for Visual, Audio, and other senses – Interaction in AR - Mobile Augmented Reality: Introduction – Augmented Reality Applications Areas- Collaborative Augmented Reality | 12 |

| | | | |
|---|---|---|---|
| | **Total Hours** | | **60** |
| CO | **Course Outcomes** | | |
| CO1 | Outline the basic terminologies, techniques and applications of VR and AR | | |
| CO2 | Describe different architectures and principles of VR and AR systems | | |
| CO3 | Use suitable hardware and software technologies for different varieties of virtual and augmented reality applications | | |
| CO4 | Analyze and explain the behavior of VR and AR technology relates to human perception and cognition | | |
| CO5 | Assess the importance of VR/AR content and interactions to implement for the real-world problem | | |
| **Textbooks** | | | |
| 1. | | Grigore C. Burdea and Philippe Coiffet, "Virtual Reality Technology", Wiley Student Edition , Second Edition (Unit I: Chapter 1,2 & Unit II: Chapter 3,4,6,8 & 9) | |
| 2. | | Alan B. Craig(2013), "Understanding Augmented Reality: Concepts and Applications"(Unit III: Chapter 1, 2, Unit IV : Chapter 3, 4 & Unit V: Chapter 5,6,8) | |
| 3. | | Jon Peddie (2017), "Augmented Reality: Where We Will All Live", Springer, Ist Edition (Unit IV: Chapter 7 (Tools & Technologies) | |
| **Reference Books** | | | |
| 1. | | Alan Craig & William R. Sherman & Jeffrey D. Will, Morgan Kaufmann(2009), "Developing Virtual Reality Applications: Foundations of Effective Design", Elsevier( Morgan Kaufmann Publishers) | |
| 2. | | Paul Mealy (2018), "Virtual and Augmented Reality", Wiley | |
| 3. | | Bruno Arnaldi & Pascal Guitton & Guillaume Moreau(2018), "Virtual Reality and Augmented Reality: Myths and Realities", Wiley | |
| NOTE: Latest Edition of Textbooks May be Used | | | |
| Web Resources | | | |
| 1. | | http://msl.cs.uiuc.edu/vr/ | |
| 2. | | http://www.britannica.com/technology/virtual-reality/Living-in -virtual-worlds | |
| 3. | | https://mobidev.biz/blog/augmented-reality-development-guide | |

**Mapping with Programme Outcomes:**

| 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** |

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** |
| **EC-DS** | **Operating Systems** | Elective | 4 | - | - | - | 3 | 4 | 25 | 75 | 100 |

| **Learning Objectives** | |
|---|---|
| LO1 | Understanding the design of the Operating System |
| LO2 | Imparting knowledge on CPU scheduling, Process and Memory Management. |
| LO3 | To code specialized programs for managing overall resources and operations of the computer. |
| LO4 | Explain theJob and processor scheduling |
| LO5 | To understand the Virtual Memory organization |

| **UNIT** | **Contents** | **No. of Hours** |
|---|---|---|
| I | **Introduction**: operating system, history (1990s to 2000 and beyond), distributed computing, parallel computation.<br><br>**Process concepts:** definition of process, process states-Life cycle of a process, process management- process state transitions, process control block(PCB), process operations , suspend and resume, context switching, Interrupts -Interrupt processing, interrupt classes, Inter | 12 |

| | | |
|---|---|---|
| | process communication-signals, message passing. | |
| II | **Asynchronous concurrent processes:** mutual exclusion- critical section, mutual exclusion primitives, implementing mutual exclusion primitives, Peterson's algorithm,software solutions to the mutual Exclusion Problem-, n-thread mutual exclusion- Lamports Bakery Algorithm. Semaphores – Mutual exclusion with Semaphores, thread synchronization with semaphores, counting semaphores, implementing semaphores.<br><br>**Concurrent programming:** monitors, message passing | 12 |
| III | **Deadlock and indefinite postponement:** Resource concepts, four necessary conditions for deadlock, deadlock prevention, deadlock avoidance and Dijkstra's Banker's algorithm, deadlock detection, deadlock recovery | 12 |
| IV | **Job and processor scheduling:** scheduling levels, scheduling objectives, scheduling criteria, preemptive vs non-preemptive scheduling, interval timer or interrupting clock, priorities, scheduling algorithms- FIFO scheduling, RR scheduling, quantum size, SJF scheduling, SRT scheduling, HRN scheduling, multilevel feedback queues, Fair share scheduling | 12 |
| V | **Real Memory organization and Management::** Memory organization, Memory management, Memory hierarchy, Memory management strategies, contiguous vs non-contiguous memory allocation, single user contiguous memory allocation, fixed partition multiprogramming, variable partition multiprogramming, Memory swapping<br><br>**Virtual Memory organization:** virtual memory basic concepts, multilevel storage organization,<br><br>block mapping, paging basic concepts, segmentation, paging/segmentation systems. | 12 |

| | | |
|---|---|---|
| | **Virtual Memory Management:** Demand Paging, Page replacement strategies | |
| | **Total** | **60** |

| **Course Outcomes** | | **Programme Outcome** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Define the fundamentals of OS and identify the concepts relevant to process , process life cycle, Scheduling Algorithms, Deadlock and Memory management | PO1 |
| CO2 | know the critical analysis of process involving various algorithms, an exposure to threads and semaphores | PO1, PO2 |
| CO3 | Have a complete study about Deadlock and its impact over OS. Knowledge of handling Deadlock with respective algorithms and measures to retrieve from deadlock. | PO4, PO5 |
| CO4 | Have complete knowledge of Scheduling Algorithms and its types. | PO4, PO5, PO6 |
| CO5 | understand memory organization and management | PO2, PO4 |

| **Text Book** | |
|---|---|
| 1 | H.M. Deitel, Operating Systems, Third Edition, Pearson Education Asia, 2011 |
| **Reference Books** | |
| 1. | William Stallings, Operating System: Internals and Design Principles, Seventh Edition, Prentice-Hall of India, 2012. |
| 2. | A. Silberschatz, and P.B. Galvin., Operating Systems Concepts, Nineth Edition, John Wiley &Sons(ASIA) Pte Ltd.,2012 |

| | |
|---|---|
| **Web Resources** | |
| 1. | Web resources from NDL Library, E-content from open-source libraries |

**Mapping with Programme Outcomes:**

| 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** |

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

# Annexure II

## Suggested topics in Skill Enhancement (SEC1-SEC8) Courses

1. Fundamentals of Information Technology
2. Introduction to HTML
3. Web Designing
4. PHP Programming
5. Software Testing
6. Understanding Internet
7. Office Automation
8. Quantitative Aptitude
9. Multimedia Systems
10. Advanced Excel
11. Biometrics
12. Cyber Forensics
13. Pattern Recognition
14. Enterprise Resource Planning
15. Simulation and Modelling
16. Organization Behavior and more

| Subject Code | Subject Name | Category | L | T | P | S | Inst. hours | Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| SEC | **Fundamentals of Information Technology** | Skill Enha. Course (SEC) | 2 | - | - | - | 2 | 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. KavithaMurugeshan (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. | | BhardwajSushilPuneet Kumar, "Fundamental of Information Technology" |
| 2. | | GG WILKINSON, "Fundamentals of Information Technology", Wiley-Blackwell |
| 3. | | A Ravichandran , "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 |
| **SEC** | **INTRODUCTION TO HTML** | Skill Enha. Course (SEC) | 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 :WebBasics: WhatisInternet–Webbrowsers–WhatisWebpage – HTMLBasics:Understandingtags. | **6** |
| II | TagsforDocumentstructure(HTML,Head,BodyTag).Blockleveltextelements:Headingsparagraph(<p> tag)–Fontstyleelements:(bold,italic,font,small,strong,strike,bigtags) | **6** |
| III | Lists:Typesoflists:Ordered,Unordered– NestingLists–Othertags:Marquee,HR,BR-UsingImages –CreatingHyperlinks. | **6** |

| | | |
|---|---|---|
| IV | Tables:CreatingbasicTable,Tableelements,Caption–Tableandcellalignment–Rowspan,Colspan–Cellpadding. | **6** |
| V | Frames:Frameset–TargetedLinks–Noframe–Forms:Input, Textarea,Select,Option. | **6** |
| | **TOTAL HOURS** | **30** |

| **Course Outcomes** | | **Programme Outcomes** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO 1 | Knows the basic concept in HTML<br>Concept of resources in HTML | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO 2 | Knows Design concept.<br>Concept of Meta Data<br>Understand the concept of save the files. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO 3 | Understand the page formatting.<br>Concept of list | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO 4 | Creating Links.<br>Know the concept of creating link to email address | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO 5 | Concept of adding images<br>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** | 14 | 15 | 14 | 14 | 15 | 15 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **contributed to each PSO** | | | | | | |

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

| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst.** | **Marks** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | **CIA** | **External** | **Total** |
| **SEC** | **WEB DESIGNING** | Skill Enha. Course (SEC) | - | - | 2 | - | 2 | 2 | 25 | 75 | 100 |

| **Learning Objectives** | |
|---|---|
| LO1 | Understand the basics of HTML and its components |
| LO2 | To study about the Graphics in HTML |
| LO3 | Understand and apply the concepts of XML and DHTML |
| LO4 | Understand the concept of JavaScript |
| LO5 | To identify and understand the goals and objectives of the Ajax |

| **UNIT** | **Details** | **No. of Hours** |
|---|---|---|
| I | **(Related programs to below concepts)** 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. | 30 |
| 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. | |
| 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). | |
| IV | Dynamic HTML: Document object model (DCOM)-Accessing HTML & CSS through DCOM Dynamic content styles & positioning-Event bubbling-data binding.<br><br>JavaScript: Client-side scripting, What is JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition, | |
| V | Advance script, JavaScript and objects, JavaScript own objects, the DOM and web browser environments, forms and validations. | |
| | **Total** | **30** |

| **Course Outcomes** | | **Programme Outcome** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Develop working knowledge of HTML | PO1, PO3, PO6, PO8 |
| CO2 | Ability to Develop and publish Web pages using Hypertext Markup Language (HTML). | PO1,PO2,PO3,PO6 |
| CO3 | Ability to optimize page styles and layout with Cascading Style Sheets (CSS). | PO3, PO5 |
| CO4 | Ability to develop a java script | PO1, PO2, PO3, PO7 |
| CO5 | 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:**

| MAPPING TABLE | | | | | | |
|---|---|---|---|---|---|---|
| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **1** | **2** | **1** | **2** |
| **CO2** | **3** | **3** | **2** | **2** | **3** | **3** |
| **CO3** | **3** | **3** | **2** | **3** | **3** | **2** |
| **CO4** | **3** | **2** | **3** | **2** | **2** | **3** |
| **CO5** | **3** | **2** | **2** | **2** | **3** | **3** |
| **Weightage of course contributed to each PSO** | **15** | **12** | **10** | **11** | **12** | **13** |

**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** |
| **SEC** | **PHP PROGRAMMING** | Skill Enha. Course (SEC) | - | - | 2 | - | 2 | 2 | 25 | 75 | 100 |
| **Learn ing Objectives** | | | | | | | | | | | |
| LO1 | To provide the necessary knowledge on basics of PHP. | | | | | | | | | | |
| LO2 | To design and develop dynamic, database-driven web applications using PHP version. | | | | | | | | | | |
| LO3 | To get an experience on various web application development techniques. | | | | | | | | | | |
| LO4 | To learn the necessary concepts for working with the files using PHP. | | | | | | | | | | |
| LO5 | To get a knowledge on OOPS with PHP. | | | | | | | | | | |
| **UNIT** | **Contents** | | | | | | | | | **No. of Hours** | |
| I | **(Related programs to below concepts)** Introduction to PHP -Basic Knowledge of websites -Introduction of Dynamic Website -Introduction to PHP -Scope of PHP -XAMPP and WAMP Installation | | | | | | | | | 30 | |
| II | PHP Programming Basics -Syntax of PHP -Embedding PHP in | | | | | | | | | | |

| | | |
|---|---|---|
| | HTML -Embedding HTML in PHP.<br>Introduction to PHP Variable -Understanding Data Types -Using Operators -Using Conditional Statements -If(), else if() and else if condition Statement. | |
| III | Switch() Statements -Using the while() Loop -Using the for() Loop PHP Functions.<br>PHP Functions -Creating an Array -Modifying Array Elements -Processing Arrays with Loops - Grouping Form Selections with Arrays -Using Array Functions. | |
| IV | PHP Advanced Concepts -Reading and Writing Files -Reading Data from a File. | |
| V | Managing Sessions and Using Session Variables -Destroying a Session -Storing Data in Cookies -Setting Cookies. | |
| | **Total** | **30** |

| **Course Outcomes** | | **Programme Outcomes** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Write PHP scripts to handle HTML forms | PO1,PO4,PO6 |
| CO2 | Write regular expressions including modifiers, operators, and metacharacters. | PO2,PO5,PO7. |
| CO3 | Create PHP Program using the concept of array. | PO3,PO4,PO5. |
| CO4 | Create PHP programs that use various PHP library functions | PO2,PO3,PO5 |
| CO5 | Manipulate files and directories. | PO3,PO5,PO6. |

| **Text Book** | |
|---|---|
| 1 | Head First PHP & MySQL: A Brain-Friendly Guide- 2009-Lynn mighley and Michael Morrison. |
| 2 | The Joy of PHP: A Beginner's Guide to Programming Interactive Web Applications with PHP and MySQL- Alan Forbes |

| **Reference Books** | |
|---|---|
| 1. | PHP: The Complete Reference-Steven Holzner. |
| 2. | DT Editorial Services (Author), "*HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)*", Paperback 2016, 2nd Edition. |

| **Web Resources** | |
|---|---|
| 1. | Opensource digital libraries: PHP Programming |
| 2. | https://www.w3schools.com/php/default.asp |

**Mapping with Programme Outcomes:**

| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 2 | 1 | 2 |
| CO2 | 3 | 3 | 2 | 2 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 2 | 2 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 3 | 3 |
| Weightage of course contributed to each PSO | 15 | 12 | 10 | 11 | 12 | 13 |

**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 |
| SEC | **SoftwareTesting** | Skill Enha. Course (SEC) | 2 | - | - | - | 2 | 2 | 25 | 75 | 100 |

| Learning Objectives | |
|---|---|
| LO1 | To study fundamental concepts in software testing |
| LO2 | To discuss various software testing issues and solutions in software unit test, integration and system testing. |
| LO3 | To study the basic concept of Data flow testing and Domain testing. |
| LO4 | To Acquire knowledge on path products and path expressions. |
| LO5 | To learn about Logic based testing and decision tables |

| UNIT | Contents | No. of Hours |
|---|---|---|

| | | |
|---|---|---|
| **I** | Introduction: Purpose–Productivity and Quality in Software–TestingVsDebugging–Model for Testing–Bugs–Types of Bugs – Testing and Design Style. | 6 |
| **II** | Flow / Graphs and Path Testing – Achievable paths – Path instrumentation Application Transaction FlowTesting Techniques. | 6 |
| **III** | Data Flow Testing Strategies - Domain Testing:Domains and Paths – Domains and Interface Testing. | 6 |
| **IV** | Linguistic –Metrics – Structural Metric – Path Products and Path Expressions.SyntaxTesting–Formats–Test Cases | 6 |
| **V** | Logic Based Testing–Decision Tables–Transition Testing–States, State Graph, StateTesting. | 6 |
| | **Total** | **30** |

| **Course Outcomes** | | **Program Outcomes** |
|---|---|---|
| **CO** | On completion of this course, students will | |
| **CO1** | Students learn to apply software testing knowledge and engineering methods | PO1 |
| **CO2** | Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation. | PO1, PO2 |
| **CO3** | 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 |
| **CO4** | Have basic understanding and knowledge of contemporary issues in software testing, such as component-based software testing problems | PO4, PO5, PO6 |
| **CO5** | 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:**

| CO/PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **1** | **2** | **1** | **2** |
| **CO2** | **3** | **3** | **2** | **2** | **3** | **3** |
| **CO3** | **3** | **3** | **2** | **3** | **3** | **2** |
| **CO4** | **3** | **2** | **3** | **2** | **2** | **3** |
| **CO5** | **3** | **2** | **2** | **2** | **3** | **3** |
| **Weightage of course contributed to each PSO** | **15** | **12** | **10** | **11** | **12** | **13** |

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

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CIA | External | Total |
| SEC | **UNDERSTANDING INTERNET** | Skill Enha. Course (SEC) | 2 | - | - | | 2 | 25 | 75 | 100 |

| **Learning Objectives** | |
|---|---|
| LO1 | Knowledge of Internet medium |
| LO2 | Internet as a mass medium |
| LO3 | Features of Internet Technology, |
| LO4 | Internetassourceof infotainment |
| LO5 | Studyofinternet audiences andabout cyber crime |

| UNIT | Contents | No. Of. Hours |
|---|---|---|
| I | Theemergenceofinternetasamassmedium–theworldof‘worldwideweb’. | **6** |
| II | Featuresofinternetasatechnology. | **6** |
| III | Internetasasourceofinfotainment – classificationbasedoncontentandstyle. | **6** |
| IV | Demographic and psychographic descriptions of internet ‘audiences’ – effect of internet onthevalues and life-styles. | **6** |
| V | Presentissuessuchascybercrimeandfuturepossibilities. | **6** |
| | **TOTAL HOURS** | **30** |

| Course Outcomes | | Programme Outcomes |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Knows the basic concept in internet<br>Concept of mass medium and world wide web | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO2 | Knows the concept of internet as a technology. | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO3 | Understand the concept of infotainment and classification based on content and style | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO4 | Can be able to know about Demographic and psychographic description of internet | PO1, PO2, PO3, PO4, PO5, PO6 |
| CO5 | Understand the concept of cyber crime and future possibilities | PO1, PO2, PO3, PO4, PO5, PO6 |

**Textbooks**


1. 01. Barnouw, E and Krishnaswamy S [1990] Indian Film. New York, OUP.
2. Kumar, Keval [1999] Mass Communication in India. Mumbai, Jaico.
3. Srivastava, K M [1992] Media Issues. Sterling Publishers Pvt Ltd.


**Reference Book**


1. Acharya, R N [1987] Television in India. Manas Publications, New Delhi.

| | |
|---|---|
| 2 | Barnouw, E [1974] Documentary – A History of Nonfiction. Oxford, OUP |
| 3 | Luthra, H R [1986] Indian Broadcasting. Ministry of I& B, New Delhi. |
| 4 | Vasudev, Aruna [1986] The New Indian Cinema. Macmillan India, New Delhi. |
| **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 |
| **SEC** | **OFFICE AUTOMATION** | Skill Enha. Course (SEC) | **2** | - | - | - | 2 | 2 | 25 | 75 | 100 |
| **Learning Objectives** | | | | | | | | | | | |
| LO1 | Understand the basics of computer systems and its components. | | | | | | | | | | |
| LO2 | Understand and apply the basic concepts of a word processing package. | | | | | | | | | | |
| LO3 | Understand and apply the basic concepts of electronic spreadsheet software. | | | | | | | | | | |

| | | |
|---|---|---|
| LO4 | Understand and apply the basic concepts of database management system. | |
| LO5 | Understand and create a presentation using PowerPoint tool. | |
| **UNIT** | **Contents** | **No. of Hours** |
| I | **Introductory concepts:** Memory unit– CPU-Input Devices: Key board, Mouse and Scanner.Outputdevices:Monitor,Printer.IntroductiontoOperatingsystems&itsfeatures:DOS– UNIX–Windows. IntroductiontoProgrammingLanguages. | 6 |
| II | **Word Processing:** Open, Save and close word document; Editing text – tools, formatting, bullets;SpellChecker - Document formatting – Paragraph alignment, indentation, headers and footers,numbering;printing–Preview,options,merge. | 6 |
| III | **Spreadsheets:**Excel– opening,enteringtextanddata,formatting,navigating;Formulas– entering,handlingand copying;Charts–creating,formatting and printing,analysistables,preparationoffinancialstatements,introductiontodataanalytics. | 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 applicationsinquerylanguage(MS–Access). | 6 |
| V | **Power point:** Introduction to Power point - Features – Understanding slide typecasting &viewingslides – creating slide shows. Applying special object – including objects & pictures – Slidetransition–Animationeffects,audioinclusion,timers. | 6 |
| | **Total** | **30** |

| **Course Outcomes** | | **Programme Outcomes** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Possess the knowledge on the basics of computers | PO1,PO2,PO3,PO6,PO8 |

| | | |
|---|---|---|
| | and its components | |
| CO2 | Gain knowledge on Creating Documents, spreadsheet and presentation. | PO1,PO2,PO3,PO6 |
| CO3 | Learn the concepts of Database and implement the Query in Database. | PO3,PO5,PO7 |
| CO4 | Demonstrate the understanding of different automation tools. | PO3,PO4,PO5,PO7 |
| CO5 | Utilize the automation tools for documentation, calculation and presentation purpose. | PO4,PO6,PO7,PO8 |
| **Text Book** | | |
| 1 | PeterNorton,"IntroductiontoComputers"–TataMcGraw-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:**

| **MAPPING TABLE** | | | | | | |
|---|---|---|---|---|---|---|
| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **2** | **3** | **3** | **3** |
| **CO2** | **3** | **3** | **3** | **3** | **3** | **3** |
| **CO3** | **3** | **3** | **3** | **3** | **3** | **3** |
| **CO4** | **3** | **3** | **3** | **3** | **3** | **3** |
| **CO5** | **3** | **3** | **3** | **3** | **3** | **3** |
| **Weightage of course contributed to each PSO** | **15** | **14** | **14** | **15** | **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 |
| SEC | **Quantitative Aptitude** | Skill Enha. Course (SEC) | 2 | - | - | - | 2 | 2 | 25 | 75 | 100 |

| **Learning Objectives** | |
|---|---|
| LO1 | To understand the basic concepts of numbers |
| LO2 | Understand and apply the concept of percentage, profit & loss |
| LO3 | To study the basic concepts of time and work, interests |
| LO4 | To learn the concepts of permutation, probability, discounts |
| LO5 | To study about the concepts of data representation, graphs |

| **UNIT** | **Contents** | **No. of Hours** |
|---|---|---|
| I | Numbers-HCF and LCM of numbers-Decimal fractions-Simplification-Square root and cube roots - Average-problems on Numbers. | 6 |
| II | Problems on Ages - Surds and Indices - percentage - profits and loss - ratio and proportion-partnership-Chain rule. | 6 |
| III | Time and work - pipes and cisterns - Time and Distance - problems on trains -Boats and streams - simple interest - compound interest - Logarithms - Area-Volume and surface area -races and Games of skill. | 6 |
| IV | Permutation and combination-probability-True Discount-Bankers Discount – Height and Distances-Odd man out & Series. | 6 |
| V | Calendar - Clocks - stocks and shares - Data representation - Tabulation – Bar Graphs- Pie charts-Line graphs. | 6 |
| | **Total** | **60** |

| **Course Outcomes** | | **Programme Outcome** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | understand the concepts, application and the problems of | PO1 |

| | | |
|---|---|---|
| | numbers | |
| CO2 | To have basic knowledge and understanding about percentage, profit & loss related processings | PO1, PO2 |
| CO3 | To understand the concepts of time and work | PO4, PO6 |
| CO4 | Speaks about the concepts of probability, discount | PO4, PO5 |
| CO5 | Understanding the concept of problem solving involved in stocks & shares, graphs | PO3, PO6 |
| **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:**

| MAPPING TABLE | | | | | | |
|---|---|---|---|---|---|---|
| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **2** | **1** | **2** | **2** | **2** |
| **CO2** | **2** | **3** | **1** | **3** | **2** | **2** |
| **CO3** | **1** | **3** | **1** | **1** | **3** | **1** |
| **CO4** | **1** | **2** | **1** | **1** | **3** | **1** |
| **CO5** | **1** | **2** | **1** | **1** | **3** | **3** |
| **Weightage of course contributed to each PSO** | **8** | **12** | **5** | **8** | **13** | **9** |

**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 |
| SEC | **Multimedia Systems** | Skill Enha. Course (SEC) | 2 | - | - | - | 2 | 2 | 25 | 75 | 100 |

| **Learning Objectives** | |
|---|---|
| **LO1** | Understand the definition of Multimedia |
| **LO2** | To study about the Image File Formats, SoundsAudio File Formats |
| **LO3** | Understand the concepts of Animation and Digital Video Containers |
| **LO4** | To study about the Stage of Multimedia Project |
| **LO5** | Understand the concept of Ownership of Content Created for Project Acquiring Talent |

| UNIT | Contents | No. of Hours | Course Objective |
|---|---|---|---|
| **I** | Multimedia Definition-Use Of Multimedia-Delivering Multimedia- Text: About Fonts and Faces - Using Text in Multimedia. | 6 | |
| **II** | Computers and Text Font Editing and Design Tools-Hypermedia and Hypertext.<br>Images: Plan Approach - Organize Tools - Configure Computer Workspace -Making Still Images - Color - Image File Formats. | 6 | |
| **III** | Sound: The Power of Sound -DigitalAudio-MidiAudio-Midivs.DigitalAudio-MultimediaSystemSoundsAudio File Formats - Vaughan's Law of Multimedia Minimums - Adding Sound to Multimedia Project | 6 | |
| **IV** | Animation: The Power of Motion-Principles of Animation-Animation by Computer - Making Animations that Work. | 6 | |
| **V** | Video: Using Video - Working with Video and Displays-Digital Video Containers-Obtaining Video Clips -Shooting and Editing Video | 6 | |
| | **Total** | **30** | |

| **Course Outcomes** | | **Programme Outcomes** |
|---|---|---|
| **CO** | On completion of this course, students will | |
| **CO1** | understand the concepts, importance, application and the process of developing multimedia | PO1 |

| | | |
|---|---|---|
| **CO2** | to have basic knowledge and understanding about image related processings | PO1, PO2 |
| **CO3** | To understand the framework of frames and bit images to animations | PO4, PO6 |
| **CO4** | Speaks about the multimedia projects and stages of requirement in phases of project. | PO4, PO5, PO6 |
| **CO5** | Understanding the concept of cost involved in multimedia planning, designing, and producing | PO3, PO6 |
| **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:**

| CO/ PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
|---|---|---|---|---|---|---|
| **CO1** | **2** | **2** | **3** | **3** | **3** | **2** |
| **CO2** | **2** | **3** | **2** | **3** | **2** | **1** |
| **CO3** | **1** | **2** | **3** | **3** | **3** | **2** |
| **CO4** | **3** | **2** | **2** | **2** | **1** | **2** |
| **CO5** | **2** | **3** | **1** | **3** | **3** | **3** |
| **Weightage of course contributed to each PSO** | **10** | **12** | **11** | **14** | **12** | **10** |

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

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| **SEC** | **Advanced Excel** | Skill Enha. Course (SEC) | - | - | 2 | - | 2 | 2 | 25 | 75 | 100 |

| **Learning Objectives** | |
|---|---|
| LO1 | Handle large amounts of data |
| LO2 | Aggregate numeric data and summarize into categories and subcategories |
| LO3 | Filtering, sorting, and grouping data or subsets of data |
| LO4 | Create pivot tables to consolidate data from multiple files |
| LO5 | Presenting data in the form of charts and graphs |

| UNIT | Contents | No. of Hours |
|---|---|---|
| I | **(Related programs to below concepts)** 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 | 30 |
| 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. | |
| 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. | |
| 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- What If Analysis - Goal Seek- Data Tables- Scenario Manager. | |
| 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. | |
| | **Total** | **30** |

| **Course Outcomes** | | **Programme Outcomes** |
|---|---|---|
| CO | On completion of this course, students will | |
| CO1 | Work with big data tools and its analysis techniques. | PO1 |
| CO2 | Analyze data by utilizing clustering and classification algorithms. | PO1, PO2 |
| CO3 | Learn and apply different mining algorithms and recommendation systems for large volumes of data. | PO4, PO6 |
| CO4 | Perform analytics on data streams. | PO4, PO5, PO6 |
| CO5 | Learn No-SQL databases and management. | PO3, PO8 |

| **Text Book** | |
|---|---|
| 1 | **Excel 2019 All** |
| 2 | **Microsoft Excel 2019 Pivot Table Data Crunching** |
| **Reference Books** | |
| | |
| 1 | Excel 2019 All-in-One for Dummies, Greg Harvey, 1st edition |

| Web Resources | |
|---|---|
| 1. | https://www.simplilearn.com |
| 2 | https://www.javatpoint.com |
| 3 | https://www.w3schools.com |

**Mapping with Programme Outcomes:**

| CO/ PSO | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 3 | 3 | 3 |
| CO2 | 3 | 2 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 3 | 3 | 3 |
| CO4 | 3 | 2 | 2 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 2 | 3 | 3 | 3 |
| Weightage of course contributed to each PSO | 15 | 12 | 10 | 15 | 15 | 15 |

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

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| SEC | **Biometrics** | Specific Elective | 2 | - | - | - | 2 | 2 | 25 | 75 | 100 |
| **Learning Objectives** | | | | | | | | | | | |
| LO1 | Identify the various biometric technologies. | | | | | | | | | | |

| | | |
|---|---|---|
| LO2 | Design of biometric recognition. | |
| LO3 | Develop simple applications for privacy | |
| LO4 | Understand the need of biometric in the society | |
| LO5 | Understand the scope of biometric techniques | |
| **UNIT** | **contents** | **No. of Hours** |
| 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.<br>**Face Biometrics:** Introduction, Background of Face Recognition, Design of Face Recognition System,<br>Neural Network for Face Recognition, Face Detection in Video Sequences, Challenges in Face Biometrics, .7 Face Recognition Methods, Advantages and Disadvantages. | 6 |
| 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<br>**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 |
| 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.<br>**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 |
| IV | **Watermarking Techniques:** Introduction, Data Hiding Methods, Basic Framework of Watermarking, | 6 |

| | | |
|---|---|---|
| | 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. | |
| 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.<br><br>**Biometric Standards:** Introduction, Standard Development Organizations, Application Programming Interface (API), Information Security and Biometric Standards, Biometric Template Interoperability. | 6 |
| | **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:**

| **MAPPING TABLE** | | | | | | |
|---|---|---|---|---|---|---|
| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **1** | **2** | **2** | **2** | **2** |
| **CO2** | **2** | **3** | **2** | **3** | **3** | **1** |
| **CO3** | **2** | **2** | **2** | **3** | **3** | **2** |
| **CO4** | **3** | **2** | **1** | **3** | **3** | **2** |
| **CO5** | **3** | **3** | **2** | **3** | **3** | **3** |
| **Weightage of course contributed to each PSO** | **13** | **11** | **9** | **14** | **14** | **10** |

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

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| **SEC** | **Cyber Forensics** | Skill Enha. Course (SEC) | 2 | - | - | - | 2 | 2 | 25 | 75 | 100 |

| **Learning Objectives** | |
|---|---|
| **LO1** | Understand the definition of computer forensics fundamentals. |
| **LO2** | To study about the Types of Computer Forensics Evidence |
| **LO3** | Understand and apply the concepts of Duplication and Preservation of Digital Evidence |
| **LO4** | Understand the concepts of Electronic Evidence and Identification of Data |
| **LO5** | To study about the Digital Detective, Network Forensics Scenario, Damaging Computer Evidence. |

| UNIT | Contents | No. of Hours |
|---|---|---|
| **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 |
| **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 |

| | | |
|---|---|---|
| **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 |
| **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 |
| **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 |
| | **Total** | **30** |
| **Course Outcomes** | | **Programme Outcomes** |
| **CO** | On completion of this course, students will | |
| **CO1** | Understand the definition of computer forensics fundamentals. | PO1 |
| **CO2** | Evaluate the different types of computer forensics technology. | PO1, PO2 |
| **CO3** | Analyze various computer forensics systems. | PO4, PO6 |
| **CO4** | Apply the methods for data recovery, evidence collection and data seizure. | PO4, PO5, PO6 |
| **CO5** | 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'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:**

| **MAPPING TABLE** | | | | | | |
|---|---|---|---|---|---|---|
| **CO/ PSO** | **PSO 1** | **PSO 2** | **PSO 3** | **PSO 4** | **PSO 5** | **PSO 6** |
| **CO1** | **3** | **1** | **2** | **2** | **2** | **2** |
| **CO2** | **2** | **3** | **2** | **3** | **3** | **1** |
| **CO3** | **3** | **2** | **2** | **3** | **3** | **2** |
| **CO4** | **3** | **3** | **1** | **3** | **3** | **2** |
| **CO5** | **3** | **3** | **2** | **3** | **3** | **3** |
| **Weightage of course contributed to each PSO** | **14** | **12** | **9** | **14** | **14** | **10** |

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

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| SEC | **Pattern Recognition** | Skill Enha. Course (SEC) | 2 | - | - | - | 2 | 2 | 75 | 25 | 100 |

| **Learning Objectives** | |
|---|---|
| LO1 | To learn the fundamentals of Pattern Recognition techniques |
| LO2 | To learn the various Statistical Pattern recognition techniques |
| LO3 | To learn the linear discriminant functions and unsupervised learning and clustering |
| LO4 | To learn the various Syntactical Pattern recognition techniques |
| LO5 | To learn the Neural Pattern recognition techniques |

| UNIT | Contents | 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-Feed-forward 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 | |
| CO1 | understand the concepts, importance, application and the process of developing Pattern recognition over view | PO1 |
| CO2 | to have basic knowledge and understanding about | PO1, PO2 |

| | | |
|---|---|---|
| | parametric and non-parametric related concepts. | |
| CO3 | To understand the framework of frames and bit images to animations | PO4, PO6 |
| CO4 | Speaks about the multimedia projects and stages of requirement in phases of project. | PO4, PO5, PO6 |
| CO5 | 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:**

| CO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | **2** | **2** | **2** | **2** |
| **CO2** | **3** | **3** | **2** | **2** | **3** | **2** |
| **CO3** | **3** | **3** | **3** | **3** | **3** | **2** |
| **CO4** | **3** | **3** | **3** | **3** | **3** | **2** |
| **CO5** | **3** | **3** | **2** | **2** | **2** | **2** |
| **Weightage of course contributed to each PSO** | **15** | **15** | **12** | **12** | **13** | **10** |

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

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| **SEC** | **Enterprise Resource Planning** | Skill Enha. Course (SEC) | 2 | - | - | - | 2 | 2 | 25 | 75 | 100 |

| **Learning Objectives** | |
|---|---|
| LO1 | To understand the basic concepts, Evolution and Benefits of ERP. |
| LO2 | To know the need and Role of ERP in logical and Physical Integration. |
| LO3 | Identify the important business functions provided by typical business software such as enterprise resource planning and customer relationship management |
| LO4 | To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth |
| LO5 | 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 Management (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, Quality 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. | PO1, PO2, PO6 |
| **CO2** | Identify different technologies used in ERP | PO2, PO3, PO4 |
| **CO3** | Understand and apply the concepts of ERP Manufacturing Perspective and ERP Modules | PO1, PO3, PO6 |
| **CO4** | Discuss the benefits of ERP | PO2, PO6 |
| **CO5** | Apply different tools used in ERP | PO1, PO3, PO5 |
| **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. | 2. https://www.oracle.com/in/erp/what-is-erp/ | |

**Mapping with Programme Outcomes:**

| MAPPING TABLE | | | | | | |
|---|---|---|---|---|---|---|
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** | **PSO6** |
| **CO1** | **3** | **3** | **3** | **2** | **2** | **2** |
| **CO2** | **3** | **3** | **2** | **2** | **3** | **2** |
| **CO3** | **3** | **3** | **3** | **3** | **3** | **2** |
| **CO4** | **3** | **3** | **3** | **3** | **3** | **2** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **CO5** | **3** | **3** | **3** | **2** | **2** | **3** |
| **Weightage of course contributed to each PSO** | **15** | **15** | **14** | **12** | **13** | **11** |

| **Subject Code** | **Subject Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | **CIA** | **External** | **Total** |
| **SEC** | **Simulation and Modeling** | Skill Enha. Course (SEC) | 2 | - | - | - | 2 | 2 | 25 | 75 | 100 |

| **Learning Objectives** | | |
|---|---|---|
| LO1 | 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 | |
| LO2 | Discuss the concepts of modelling layers of critical infrastructure networks in society. | |
| LO3 | Create tools for viewing and controlling simulations and their results. | |
| LO4 | Understand the concept of Entity modelling, Path planning | |
| LO5 | To learn about the Algorithms and Modelling. | |
| **UNIT** | **Details** | **No. of Hours** |
| 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 |
| II | Random Variate Generation – Random Numbers – Random Number Generators – General principles – | 6 |

| | | |
|---|---|---|
| | 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 of Initialization Bias (Warm-up Interval) - Replication-Deletion Approach - Batch-Means Method . | |
| 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 |
| 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 |
| V | Optimization Algorithms – Genetic Algorithms – Simulated Annealing Examples: Sensor Systems Modeling – Human Eye Modeling – Optical Sensor | 6 |

| | | |
|---|---|---|
| | Modeling – Radar Modeling. | |
| | **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, PO5 |
| **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, PanduTadikamalla, "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:**

| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** |
|---|---|---|---|---|---|---|
| **CO 1** | **3** | **2** | **2** | **3** | **3** | **2** |
| **CO 2** | **3** | **3** | **2** | **3** | **3** | **2** |
| **CO 3** | **3** | **3** | **3** | **3** | **3** | **2** |
| **CO 4** | **3** | **3** | **2** | **3** | **3** | **2** |
| **CO 5** | **3** | **3** | **2** | **3** | **3** | **2** |
| | **15** | **14** | **11** | **15** | **15** | **10** |

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

| Subject Code | Subject Name | Category | L | T | P | O | Credits | Inst. Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| **SEC** | **Organizational Behaviour** | Skill Enha. Course (SEC) | 2 | - | - | - | 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** | **Contents** | **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:**<br>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.<br>2. Motivation : Concept; Theories (Hierarchy of needs, X and Y, Two factor, McClelland, Goal setting, Self-efficacy, Equity theory); Job characteristics model; Redesigning jobs,<br>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)<br>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)<br>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 | 6 |

| | | |
|---|---|---|
| | of culture; Impact (functions and liability); Creating and sustaining culture: Concept of structure, Prevalent organizational designs: New design options | |
| 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**

| **Course Outcomes** | On Completion of the course the students will | **Program Outcomes** |
|---|---|---|
| **CO1** | To define OrganisationalBehaviour, Understand the opportunity through OB. | PO1, PO2, PO6 |
| **CO2** | To apply self-awareness, motivation, leadership and learning theories at workplace. | PO2,PO4. PO5, PO6 |
| **CO3** | To analyze the complexities and solutions of group behaviour. | PO1, PO2, PO4, PO5, PO6 |
| **CO4** | To impact and bring positive change in the culture of the organisaiton. | PO2, PO3, PO4 PO5, |
| **CO5** | To create a congenial climate in the organization. | PO1, PO2, PO5 PO6, |

**Text Books**

| | |
|---|---|
| 1. | NeharikaVohra Stephen P. Robbins, Timothy A. Judge , *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, Allison Shearsett, Rachael Collinson, *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**

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|---|---|
| 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. |