# ACADEMIC CURRICULA

## POSTGRADUATE DEGREE PROGRAMME

Two Years (Full-Time)

Learning Outcome Based Education

Choice Based Flexible Credit System

Academic Year

2022 – 2023

SRM INSTITUTE OF SCIENCE & TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

**SRM INSTITUTE OF SCIENCE AND TECHNOLOGY**

**(Deemed to be University u/s 3 of UGC Act, 1956)**

**Kattankulathur, Chengalpattu District 603203, Tamil Nadu, India**

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY
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## DEPARTMENT OF COMPUTER SCIENCE

| 1. Department Vision Statement | |
|---|---|
| Stmt - 1 | Always strive to be the frontiers in learning and inculcating the technical skills and knowledge to excel in all possible dimensions. |
| Stmt - 2 | Energizing the art of learning to explore beyond professional assignments through research. |
| Stmt - 3 | Contribute to the growth of the nation and society by applying acquired knowledge in technical, computing and managerial skills. |

| 2. Department Mission Statement | |
|---|---|
| Stmt - 1 | To provide a great platform to learn and practice technologies to meet the growing demands in the industries |
| Stmt - 2 | To be distinguished as an renowned department for learning, experimenting and continuing research |
| Stmt - 3 | Encouraging the students to understand the best of practices and standards of software and apply the same while developing applications that benefits the society |
| Stmt - 4 | To make the learners recognize the need for engaging themselves in continuing professional development |
| Stmt - 5 | Promoting students to integrate technical ability and IT-based solutions into appropriate user environments |

| 3. Program Education Objectives (PEO) | |
|---|---|
| PEO - 1 | Proficiency: Understanding the principles of computing, mathematics, and basic sciences and apply the same to the development of applications across various disciplines of study and utility |
| PEO - 2 | Analytical Ability: Developing skillfulness to identify and analyze user needs and take them into account in the selection, creation, evaluation, and administration of computer-based systems |
| PEO - 3 | Continuous learning: Helps and supports to use current techniques, skills, and tools necessary for computing practices and imbibe the art of adaptive learning towards the technologies to come |
| PEO - 4 | Demonstration Skill: An ability to communicate effectively with a range of audiences |
| PEO - 5 | Social Connect: An understanding of professional, ethical, legal, security and social issues, responsibilities |

| 4. Consistency of PEO's with Mission of the Department | | | | | |
|---|---|---|---|---|---|
| | Mission Stmt. - 1 | Mission Stmt. - 2 | Mission Stmt. - 3 | Mission Stmt. - 4 | Mission Stmt. – 5 |
| PEO - 1 | H | H | M | H | M |
| PEO - 2 | H | M | H | H | H |
| PEO - 3 | M | H | M | H | H |
| PEO - 4 | H | H | H | L | M |
| PEO - 5 | L | H | M | H | H |

H – High Correlation, M – Medium Correlation, L – Low Correlation

## 1. PG Programme Structure (Total Credits:80)

**1. Professional Core Courses (C)**

(8Courses)

| Course Code | Course Title | Hours/ Week | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| PCS21C01J | Advanced Data Structures | 3 | 0 | 4 | 5 |
| PCS21C02J | Advanced Java Programming | 3 | 0 | 4 | 5 |
| PCS21C03J | Computer Networks | 3 | 0 | 4 | 5 |
| PCS21C04J | Open Source Technologies | 3 | 0 | 4 | 5 |
| PCS21C05J | Distributed Operating System | 3 | 0 | 4 | 5 |
| PCS21C06J | Big Data Analytics | 3 | 0 | 4 | 5 |
| PCS21C07J | Python Programming | 4 | 0 | 2 | 5 |
| PCS21C08J | Theory of Computation | 4 | 0 | 2 | 5 |
| **Total Learning Credits** | | | | | **40** |

**2. Discipline Elective Courses (D)**

(3 Courses)

| Course Code | Course Title | Hours/ Week | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| PCS21E01J | Artificial Intelligence and Expert Systems | 3 | 0 | 2 | 4 |
| PCS21E02J | Cloud Computing | | | | |
| PCS21E03J | Image Processing using Matlab | | | | |
| PCS21E04J | Advanced Machine Learning | 3 | 0 | 2 | 4 |
| PCS21E05J | Internet of Things | | | | |
| PCS21E06J | Block Chain Technologies | | | | |
| PCS21E07J | Statistical Data Analytics | 3 | 0 | 2 | 4 |
| PCS21E08J | Cryptography and Network Security | | | | |
| PCS21E09J | Compiler Design | | | | |
| **Total Learning Credits** | | | | | **12** |

**3. Generic Elective Courses (G)**

(Any 1Course)

| Course Code | Course Title | Hours/ Week | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| PCS21G01J | Deep Learning for Data Science | 3 | 0 | 2 | 4 |
| PCS21G02J | Software Engineering | | | | |
| PCS21G03J | Research Methodology | | | | |
| **Total Learning Credits** | | | | | **4** |

**4. Skill Enhancement Courses(S)**

(3 Courses)

| Course Code | Course Title | Hours/ Week | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| PCS21S01J | Information Literacy | 1 | 0 | 2 | 2 |
| PCS21S02J | Data Mining and Data Warehousing | 1 | 0 | 2 | 2 |
| PCS21S03J | Web Development Using AngularJS and Mongo | 3 | 0 | 2 | 4 |
| **Total Learning Credits** | | | | | **8** |

**5. Project Work, Internship In Industry / Higher Technical Institutions(P)**

| Course Code | Course Title | Hours/ Week | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| PCS21E31L | Miniproject | 0 | 0 | 2 | 1 |
| PCS21E41L | Project Work | 0 | 0 | 24 | 12 |
| **Total Learning Credits** | | | | | **13** |

**6.Ability Enhancement Courses (AE)**

(3 Courses)

| Course Code | Course Title | Hours/ Week | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| PCD21AE1T | Professional Skills and Problem Solving | 1 | 0 | 0 | 1 |
| PCD21AE2T | General Aptitude For Competitive Examinations | 1 | 0 | 0 | 1 |
| PCD21AE3T | Employability Skills | 1 | 0 | 0 | 1 |
| **Total Learning Credits** | | | | | **3** |

**1. Program Articulation Matrix**

| Course Code | Course Name | Programme Learning Outcomes | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Disciplinary Knowledge | Critical Thinking | Problem Solving | Analytical Reasoning | Research Skills | Team Work | Scientific Reasoning | Reflective Thinking | Self-Directed Learning | Multicultural Competence | Ethical Reasoning | Community Engagement | ICT Skills | Leadership Skills | Life Long Learning |
| PCS21C01J | Advanced Data Structures | H | H | H | H | H | L | M | L | M | M | H | H | M | H | H |
| PCS21C02J | Advanced Java Programming | H | H | H | H | H | L | M | L | M | M | H | H | M | H | H |
| PCS21C03J | Computer Networks | H | H | H | H | H | L | M | L | M | M | H | H | M | H | H |
| PCS21C04J | Open Source Technologies | H | H | H | H | H | L | M | L | M | M | H | H | M | H | H |
| PCS21C05J | Distributed Operating System | H | H | H | H | H | L | M | L | M | M | H | H | M | H | H |
| PCS21C06J | Big Data Analytics | H | H | H | H | H | L | M | L | M | M | H | H | M | H | H |
| PCS21C07J | Python Programming | H | H | H | H | H | L | M | L | M | M | H | H | M | H | H |
| PCS21C08J | Theory of Computation | H | H | H | H | H | L | M | L | M | M | H | H | M | H | H |
| PCS21E01J | Artificial Intelligence and Expert Systems | H | H | H | H | H | M | H | M | M | M | H | H | H | M | M |
| PCS21E02J | Cloud Computing | H | H | H | H | H | M | H | M | M | M | H | H | H | M | M |
| PCS21E03J | Image Processing using Matlab | H | H | H | H | H | M | H | M | M | M | H | H | H | M | M |
| PCS21E04J | Advanced Machine Learning | H | H | H | H | H | M | H | M | M | M | H | H | H | M | M |
| PCS21E05J | Internet of Things | H | H | H | H | H | M | H | M | M | M | H | H | H | M | M |
| PCS21E06J | Block Chain Technologies | H | H | H | H | H | M | H | M | M | M | H | H | H | M | M |
| PCS21E07J | Statistical Data Analytics | H | H | H | H | H | M | H | M | M | M | H | H | H | M | M |
| PCS21E08J | Cryptography and Network Security | H | H | H | H | H | M | H | M | M | M | H | H | H | M | M |
| PCS21E09J | Compiler Design | H | H | H | H | H | M | H | M | M | M | H | H | H | M | M |
| PCS21G01J | Deep Learning for Data Science | H | H | H | H | H | L | M | L | M | H | M | M | H | H | M |
| PCS21G02J | Software Engineering | H | H | H | H | H | L | M | L | M | H | M | M | H | H | M |
| PCS21G03J | Research Methodology | H | H | H | H | H | L | M | L | M | H | M | M | H | H | M |
| PCS21S01J | Information Literacy | H | H | H | H | H | L | M | L | M | M | H | H | M | H | H |
| PCS21S02J | Data Mining and Data Warehousing | H | H | H | H | H | L | M | L | M | H | M | M | H | H | M |
| PCS21S03J | Web Development Using AngularJS and Mongo | H | H | H | H | H | M | H | M | M | M | H | H | H | M | M |
| PCS21E31L | Miniproject | H | H | H | H | H | L | M | L | M | M | M | H | M | H | H |
| PCS21E41L | Project Work | H | H | H | H | H | L | M | L | M | M | M | H | M | H | H |
| PCD21AE1T | Professional Skills and Problem Solving | H | H | H | H | H | M | H | M | M | M | H | H | H | M | M |
| PCD21AE2T | General Aptitude For Competitive Examinations | H | H | H | H | H | M | H | M | M | M | H | H | H | M | M |
| PCD21AE3T | Employability Skills | H | H | H | H | H | M | H | M | M | M | H | H | H | M | M |
| | **Program Average** | H | H | H | H | H | M | M | M | M | M | M | H | H | H | H |

| Course Structure | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Semester** | **Professional Core Courses (PCC)** | **Discipline Electives Courses (DEC)** | **Generic Electives Courses (GEC)** | **Skill Enhancement Courses(SEC)** | **Ability Enhancement Courses(AEC)** | **Project Work, Internship (P)** | **Total Credits** | **Total Hours** |
| **Sem I** | PCC-1(7)<br>PCC-2 (7)<br>PCC-3(7) | DEC-1 (5) | | SEC 1 (3) | AEC 1 (1) | | **22** | **30** |
| **Sem II** | PCC-4 (7)<br>PCC-5 (7)<br>PCC-6 (7) | DEC-2 (5)- | | SEC 2 (3) | AEC 2 (1) | | **22** | **30** |
| **Sem III** | PCC-7(6)<br>PCC-8(6) | DEC-3(5) | GEC(5) | SEC3(5) | AEC3(1) | P (2) | **24** | **30** |
| **Sem IV** | | | | | | P (24) | **12** | **30** |
| **Total Credits** | **40** | **12** | **4** | **8** | **3** | **13** | **80** | **120** |

## 1. Implementation Plan

**Semester - I**

| Course Code | Course Title | Hours/ Week | | | C |
|---|---|---|---|---|---|
| | | L | T | P | |
| PCS21C01J | Advanced Data Structures | 3 | 0 | 4 | 5 |
| PCS21C02J | Advanced Java Programming | 3 | 0 | 4 | 5 |
| PCS21C03J | Computer Networks | 3 | 0 | 4 | 5 |
| PCS21E01J | Artificial Intelligence and Expert Systems | 3 | 0 | 2 | 4 |
| PCS21E02J | Cloud Computing | | | | |
| PCS21E03J | Image Processing using Matlab | | | | |
| PCS21S01J | Information Literacy | 1 | 0 | 2 | 2 |
| PCD21AE1T | Professional Skills and Problem Solving | 1 | 0 | 0 | 1 |
| | Total Hours | | | | 30 |
| | Total Learning Credits | | | | 22 |

**Semester - II**

| Course Code | Course Title | Hours/ Week | | | C |
|---|---|---|---|---|---|
| | | L | T | P | |
| PCS21C04J | Open Source Technologies | 3 | 0 | 4 | 5 |
| PCS21C05J | Distributed Operating System | 3 | 0 | 4 | 5 |
| PCS21C06J | Big Data Analytics | 3 | 0 | 4 | 5 |
| PCS21E04J | Advanced Machine Learning | 3 | 0 | 2 | 4 |
| PCS21E05J | Internet of Things | | | | |
| PCS21E06J | Block Chain Technologies | | | | |
| PCS21S02J | Data Mining and Data Warehousing | 1 | 0 | 2 | 2 |
| PCD21AE2T | General Aptitude For Competitive Examinations | 1 | 0 | 0 | 1 |
| | Total Hours | | | | 30 |
| | Total Learning Credits | | | | 22 |

**Semester – III**

| Course Code | Course Title | Hours/ Week | | | C |
|---|---|---|---|---|---|
| | | L | T | P | |
| PCS21C07J | Python Programming | 4 | 0 | 2 | 5 |
| PCS21C08J | Theory of Computation | 4 | 0 | 2 | 5 |
| PCS21E07J | Statistical Data Analytics | 3 | 0 | 2 | 4 |
| PCS21E08J | Cryptography and Network Security | | | | |
| PCS21E09J | Compiler Design | | | | |
| PCS21G01J | Deep Learning for Data Science | 3 | 0 | 2 | 4 |
| PCS21G02J | Software Engineering | | | | |
| PCS21G03J | Research Methodology | | | | |
| PCS21E31L | Miniproject | 0 | 0 | 2 | 1 |
| PCS21S03J | Web Development Using AngularJS and Mongo | 3 | 0 | 2 | 4 |
| PCD21AE3T | Employability Skills | 1 | 0 | 0 | 1 |
| | Total Hours | | | | 30 |
| | Total Learning Credits | | | | 24 |

**Semester - IV**

| Course Code | Course Title | Hours/ Week | | | C |
|---|---|---|---|---|---|
| | | L | T | P | |
| PCS21E41L | Project Work | 0 | 0 | 24 | 12 |
| | Total hours | | | | 24 |
| | Total Learning Credits | | | | 12 |

**Total Learning Credits :80**

**Regulations-2020**

1. **Eligibility**

   B.Sc-Computer Science or B.Sc-IT or BCA or B.Sc-Mathematics or B.Sc-Statistics or B.Sc-Physics or B.Sc-Electronics, Triple major subject with Computer Science as one of the major subjects.

2. **To award degree- Total 80 credits required.**

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**SEMESTER-1**

| Course Code | PCS21C01J | Course Name | ADVANCED DATA STRUCTURES | Course Category | C | Professional Core Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 | 0 | 4 | 5 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: | Learning | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) |
| CLR-1 : | *Discuss the computational efficiency of the sorting and searching algorithms.* | | | |
| CLR-2 : | *Describe how arrays, linked lists, stacks, queues, trees, and graphs are represented in memory.* | | | |
| CLR-3 : | *Implementation of Trees and Graphs and perform various operations on these data structure.* | | | |
| CLR-4 : | *Understanding the concept of recursion, application of recursion and its implementation and removal of recursion.* | | | |
| CLR-5 : | *Identify the alternative implementations of data structures with respect to its performance to solve a real world problem.* | | | |
| CLR-6 : | *Utilize algorithms to find shortest data search in graphs for real-time application development.* | | | |

| Course Learning Outcomes (CLO): | At the end of this course, learners will be able to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Disciplinary Knowledge | Critical Thinking | Problem Solving | Analytical Reasoning | Research Skills | Team Work | Scientific Reasoning | Reflective Thinking | Self-Directed Learning | Multicultural Competence | Ethical Reasoning | Community Engagement | PSO 1 | PSO 2 | PSO 3 |
| CLO-1 : | *Identify linear and non-linear data structures. Create algorithms for searching and sorting.* | 3 | 80 | 70 | L | H | - | H | L | | | | | | | | - | - | - |
| CLO-2 : | *To improve the problem solving quality using data structure techniques.* | 3 | 85 | 75 | M | H | L | M | L | | | | | | | | - | - | - |
| CLO-3 : | *Create the different types of linked lists and evaluate its operations.* | 3 | 75 | 70 | M | H | M | H | L | | | | | | | | - | - | - |
| CLO-4 : | *Describe how arrays, linked lists, stacks, queues, trees, and graphs are represented in memory,used by the algorithms and their common applications.* | 3 | 85 | 80 | M | H | M | H | L | | | | | | | | - | - | - |
| CLO-5 : | *Construct the different data structures and evaluate their types and operations.* | 3 | 85 | 75 | H | H | M | H | L | | | | | | | | - | - | - |
| CLO-6 : | *Create graph data structure, evaluate its operations, implement algorithms to identify shortest path* | 3 | 85 | 80 | M | H | M | H | L | | | | | | | | - | - | - |

| Duration(Hour) | | 21 | 21 | 21 | 21 | 21 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Linear Data Structures* | *Tree Structures* | *Introduction to Tree Search* | *Introduction to Graphs* | *Algorithms* |
| | SLO-2 | *Introduction to Data Structure* | *Introduction to Tree Structure* | *Balanced Search Trees* | *Objective of Graphs* | *Introduction to Algorithms* |
| S-2 | SLO-1 | *Algorithm Analysis* | *Non-Linear Structures* | *Sorting* | *Definitions of Graphs* | *Divide and conquer* |
| | SLO-2 | *Asymptotic Notations* | *Need for Non-Linear Structures* | *Indexing* | *Representation of Graph* | *Objective of Divide and conquer algorithm* |
| S-3 | SLO-1 | *Introduction ADT* | *Trees* | *Introduction to AVL* | *Graph Traversals* | *Binary Search* |
| | SLO-2 | *Abstract Data Types (ADT)* | *Tree Representation* | *AVL Trees* | *Applications of Graphs* | *Greedy algorithm* |
| S-4 to S-7 | SLO-1 | *Laboratory 1: Recursion* | *Laboratory 4 : stack and its applications* | *Laboratory 7 : Tree Traversals* | *Laboratory 10 : Implementation of Bubble and Insertion sort* | *Laboratory 13: Implementation of Graph using Array* |
| S-8 | SLO-1 | *ADT Objectives* | *Binary Tree* | *B-Trees* | *Sorting* | *Knapsack Problem* |
| | SLO-2 | *The Arrays* | *Tree Traversals* | *Sorting* | *Topological Sort* | *Dynamic Programming* |
| S-9 | SLO-1 | *The Stack* | *Expression Trees* | *Bubble sort* | *Shortest path algorithms* | *Merits of Dynamic programming* |
| | SLO-2 | *Queue* | *Binary tree traversals* | *Quick Sort* | *Spanning Tree* | *Multistage Graph* |
| S-10 | SLO-1 | *Circular Queue* | *General Trees* | *Insertion Sort* | *Minimum Cost Spanning Tree* | *Backtracking* |
| | SLO-2 | *Applications of Stack* | *Data Structure for General trees* | *Heap sort* | *Advantages of Minimum cost Spanning tree* | *Objective of Backtracking* |

| Duration(Hour) | | 21 | 21 | 21 | 21 | 21 |
|---|---|---|---|---|---|---|
| S-11 to S-14 | SLO-1 | *Laboratory 2: Arrays, structure using pointers* | *Laboratory 5: Queue implementation using array and pointers* | *Laboratory 8: Implementation of BST* | *Laboratory 11 : Implementation of Qucik sort and merge sort* | *Laboratory 14 : Implementation of shortest path algorithm* |
| S-15 | SLO-1 | *Application of Queue* | *Applications of trees* | *Hashing* | *Prim's Algorithm* | *Sum of Subset* |
| | SLO-2 | *Infix to Postfix conversion* | *Algorithm* | *Hashing Function* | *Representation of Prim's Algorithm* | *Sum of Subset Problem* |
| S-16 | SLO-1 | *Evaluation of Expression* | *Types of Algorithm* | *Collision Resolution Techniques* | *Kruskal's Algorithm* | *Branch And Bound Problem* |
| | SLO-2 | *Linked Lists* | *Objective of Binary tree* | *Separation Chaining* | *Merits of Kruskal's Algorithm* | *Branch and Bound Representation* |
| S-17 | SLO-1 | *Doubly Linked List* | *Huffman Algorithm* | *Open Addressing* | *Demerits of Kruskal's Algorithm* | *Travelling Salesman problem* |
| | SLO-2 | *Application of linked list* | *Binary Search tree.* | *Multiple hashing* | *Kruskal's Algorithm Representation* | *Travelling Salesman problem Representation* |
| S-18 to S-21 | SLO-1 | *Laboratory 3 : Linked List* | *Laboratory 6: Implementation of binary tree using Arrays* | *Laboratory 9 :Heap Implementation* | *Laboratory 12: Linear search and Binary search* | *Laboratory 15 : Implementation of minimum spanning tree* |

| Learning Resources | 1. Anany Levitin (2011), "Introduction to the Design and Analysis of Algorithms", Addison Wesley Professional. (Unit I). | 2. Seymore Litschutz,Schaum Outline ,"Data Structures", Adapted by G.A.V PAI, McGrawHill. (For Units II to V). |
|---|---|---|

**Learning Assessment**

| Bloom's Level of Thinking | | Continous Learning Assessment(50% Weightage) | | | | | | | | Final Examination (50% weightage) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4# (10%) | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100% | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

| Course Designers | | |
|---|---|---|
| **Experts from Industry** | **Experts from Higher Technical Institutions** | **Internal Experts** |
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr. S. Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | Dr. S. Kanchana |
| | | Mr. Ramesh |

| Course Code | PCS21C02J | Course Name | ADVANCED JAVA PROGRAMMING | Course Category | C | Professional Core Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 | 0 | 4 | 5 |

| Pre-requisite Courses | Java Programming | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | Nil | | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: | Learning | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) |
| CLR-1 : | *This course is designed to teach the student how to write, test, and debug advanced-level Object-Oriented programs using Java with a heavy emphasis towards database and web application development* | | | |
| CLR-2 : | *Learn how to write, test, and debug distributed applications using Java* | | | |
| CLR-3 : | *To work with Web and Application Servers like Apache Tomcat, Glassfish etc and understand the communication over HTTP protocol.* | | | |
| CLR-4 : | *Develop web application using Java Servlet and Server Pages technology* | | | |
| CLR-5 : | *Develop Enterprise applications using EJB* | | | |
| CLR-6 : | *Learn the foundations of the MVC architecture* | | | |

| Course Learning Outcomes (CLO): | At the end of this course, learners will be able to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Fundamental Knowledge | Application of Concepts | Link with Related Disciplines | Procedural Knowledge | Skills in Specialization | Ability to Utilize Knowledge | Skills in Modeling | Analyze, Interpret Data | Investigative Skills | Problem Solving Skills | Communication Skills | Analytical Skills | PSO 1 | PSO 2 | PSO 3 |
| CLO-1 : | *Write distributed and Network applications using Java* | 3 | 80 | 70 | L | H | - | H | L | - | - | - | | | | | - | - | - |
| CLO-2 : | *To write java applications that communicate with diverse databases* | 3 | 85 | 75 | M | H | L | M | L | - | - | - | | | | | - | - | - |
| CLO-3 : | *Create Web applications using Servlets* | 3 | 75 | 70 | M | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-4 : | *Understand and implement session handling in web pages* | 3 | 85 | 80 | M | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-5 : | *Role of EJB in Server-side programming* | 3 | 85 | 75 | H | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-6 : | *Develop a fully functional web applications with the MVC design pattern* | 3 | 80 | 70 | L | H | M | H | L | - | - | - | | | | | - | - | - |

| Duration (hour) | | 21 | 21 | 21 | 21 | 21 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Applications in distributed environment Overview of RMI* | *Database access and servlet programming* | *Introduction to JSP* | *EJB Overview* | *Understanding the need for MVC* |
| | SLO-2 | *Introduction to RMI* | *Introduction to JDBC connection* | *JSP Working Principle & Architecture* | *EJB Architecture: Logical* | *MVC overview* |
| S-2 | SLO-1 | *Developing an RMI Application* | *JDBC Drivers- Driver types* | *Life Cycle of JSP* | *EJB Architecture: Software Architecture* | *Frameworks* |
| | SLO-2 | *Activation models* | *Connecting to a Database* | *Components of a JSP page: Scripting Component* | *View of EJB Conversation* | *Architecture* |
| S-3 | SLO-1 | *Architecture of an RMI Application* | *Statement Interfaces* | *JSP Directives* | *Building and Deploying EJB's* | *Implementing MVC with request dispatcher* |
| | SLO-2 | *RMI custom sockets* | *PreparedS tatement and Callable Statement* | *JSP Action Elements* | *EJB Stateless Bean constraints on session beans Life Cycle with example* | *Implementing MVC with request dispatcher* |
| S 4-7 | SLO-1 | *Laboratory 1: Create distributed applications using RMI* | *Laboratory4: Create applications which can demonstrate the use of JDBC for Database Connectivity. Insert, update, delete record* | *Laboratory 7: Web Applications using JSP Include Directive JSP: include Action* | *Laboratory 10: An EJB application that demonstrates Session Bean- Stateless Bean* | *Laboratory 13: MVC Architecture(i) Implementing MVC with Request Dispatcher(ii) Data Sharing Approaches* |
| | SLO-2 | | | | | |
| S-8 | SLO-1 | *Object Serialization* | *Working with ResultSet* | *JSP Implicit Objects* | *EJB Stateful Bean* | *Defining Beans to represent the data* |

| Duration (hour) | | 21 | 21 | 21 | 21 | 21 |
|---|---|---|---|---|---|---|
| | SLO-2 | *Serialization Object Serializable Interface Example of object Serialization* | *JDBC using Using MetaData* | *JSP Request Processing* | *EJB Entity Beans: When to use Entity Bean* | *writing servlets to handle requests* |
| S-9 | SLO-1 | *RMI – IIOP* | *Background – Servlet* | *Request Dispatcher Object* | *Entity Bean Life Cycle* | *populating Beans methods* |
| | SLO-2 | *IIOP with example* | *Types: Generic Servlet, GenericServlet class* | *JSP Server Response* | *Primary keys, And its implementation* | *storing the results* |
| S10 | SLO-1 | *Relationship between RMI – IIOP* | *HttpServlet HttpServlet class* | *Model1 Vs Model2 JSP Model1 and Model2 Architectures* | *Uses and Methods of Bean-Managed Versus Container Managed Persistence* | *forwarding the requests* |
| | SLO-2 | *Introduction to COBRA* | *Servlet Life Cycle Life Cycle of a Servlet* | *Request Redirection is JSP* | *Example: Container Managed Persistence* | *Categories of beans storing and retrieving* |
| S 11-14 | SLO-1 | *Laboratory 2: converting an RMI application to RMI-IIOP.* | *Laboratory 5: Develop Web Applications Using Servlet Develop Web Applications Using ServletRequest, ServletResponse* | *Laboratory8: Create a JSP based Web application which allows the user to edit his/her database Information.* | *Laboratory11: Develop a web program to execute EJB: Entity Beans* | *Laboratory 14: Build a web application defining Beans to represent the data* |
| | SLO-2 | | | | | |
| S-15 | SLO-1 | *Development of CORBA applications* | *Servlet Request* | *JSP and Java Bean:* | *Bean Managed persistence- methods and classes* | *summarizing the MVC code* |
| | SLO-2 | *CORBA programming models* | *ServletResponse* | *Java Bean Types and methods* | | *interpreting relative URL* |
| S-16 | SLO-1 | *CORBA structures* | *Servlet Context* | *JSP and XML* | *Message Driven Beans: implementation* | *three data sharing approaches* |
| | SLO-2 | *Java IDL, IDL Technology* | *ServletConfig* | *XML Overview* | *Message Driven Beans: Life Cycle.* | *Request based sharing* |
| S-17 | SLO-1 | *Naming services And its categories* | *Methods of Servlet Interface, Single Thread Model, Thread Model* | *Methods of XML Parsers* | *EJB – Database Access* | *Session based sharing* |
| | SLO-2 | *JAR file creation.* | *Session Tracking: Cookies URL Rewriting, Hidden Fields, The Session API Session API* | *XSL Transformations with XSLT* | *EJB : Exception Handling* | *Application based sharing* |
| S 18-21 | SLO-1 | *Laboratory 3: Create application using COBRA, Create a sample JAR file* | *Laboratory 6: Program that demonstrates the use of session management in Servlet.* | *Laboratory 9: Develop a web application for XML Perform XSL Transformations with XSLT* | *Laboratory12: Program on Managed persistence- Message Driven Beans:* | *Laboratory 15: Implement the various data sharing approaches .* |
| | SLO-2 | | | | | |

| **Learning Resources** | 1. Elliotte Rusty Harold, (2013), "Java Network Programming", O'Reilly Publishers. (For Unit I to III) | 2. Antonio Goncalves, (2010), "Beginning Java EE 6 Platform with GlassFish 3", Apress, Second Edition. (For Units IV to V) |
|---|---|---|

**Learning Assessment**

| Bloom's Level of Thinking | | Continous Learning Assessment(50% Weightage) | | | | | | | | Final Examination (50% weightage) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4# (10%) | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100% | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

| Course Designers | | |
|---|---|---|
| **Experts from Industry** | **Experts from Higher Technical Institutions** | **Internal Experts** |
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr. S. Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | Dr. Sweety Bakyarani. E<br>Mrs. P. Yogalakshmi |

| Course Code | PCS21C03J | Course Name | COMPUTER NETWORKS | Course Category | C | Professional Core Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 | 0 | 4 | 5 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Applications | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to, | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| CLR-1 : | *Understand the evolution of computer networks using the layered network architecture* | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Disciplinary Knowledge | Critical Thinking | Problem Solving | Analytical Reasoning | Research Skills | Team Work | Scientific Reasoning | Reflective Thinking | Self-Directed Learning | Multicultural Competence | Ethical Reasoning | Community Engagement | PSO 1 | PSO 2 | PSO 3 |
| CLR-2 : | *Understand the addressing concepts and learn networks devices* | | | | | | | | | | | | | | | | | | |
| CLR-3 : | *Design computer networks using subnetting and routing concepts* | | | | | | | | | | | | | | | | | | |
| CLR-4 : | *Understand the error types , framing, flow control* | | | | | | | | | | | | | | | | | | |
| CLR-5 : | *Understand the various Medium Access Control techniques and also the characteristics of physical layer functionalities* | | | | | | | | | | | | | | | | | | |
| CLR-6 : | *Understand basic network administration* | | | | | | | | | | | | | | | | | | |
| **Course Learning Outcomes (CLO):** | At the end of this course, learners will be able to: | | | | | | | | | | | | | | | | | | |
| CLO-1 : | *Acquire the basics of computer network and its architecture* | 3 | 80 | 70 | L | H | H | H | H | M | - | | | | | | | | |
| CLO-2 : | *Acquire the knowledge of various networks devices and addressing methods* | 3 | 85 | 75 | M | M | H | H | H | - | - | | | | | | | | |
| CLO-3 : | *Abilty to design the network routing methods* | 3 | 75 | 70 | M | M | H | H | H | - | - | | | | | | | | |
| CLO-4 : | *Acquire the various error codes and framing concepts* | 3 | 85 | 80 | L | L | H | H | H | M | - | | | | | | | | |
| CLO-5 : | *Ability to understand the physical layer functions and components* | 3 | 75 | 70 | H | H | H | H | H | L | - | | | | | | | | |
| CLO-6 : | *Ability to design a computer network using a switch and router* | 3 | 85 | 80 | L | H | H | H | H | H | - | | | | | | | | |

| Duration (hour) | | 21 | 21 | 21 | 21 | 21 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *A Communications Model* | *Transmission Terminology* | *Asynchronous Transmission* | *Frequency Division Multiplexing Synchronous* | *Local Area Network Overview- Background* |
| | SLO-2 | *A Data Communications Model-Networks* | *Frequency, Spectrum, And Bandwidth* | *Synchronous Transmission* | *Time Division Multiplexing* | *Topologies And Transmission Media* |
| S-2 | SLO-1 | *Operation of TCP and IP* | *Data And Signals- -* | *Error Correction-* | *Circuit-Switching Networks* | *IEEE 802 Reference Model* |
| | SLO-2 | *TCP* | *Analog And Digital Transmission* | *Block Code Principles* | *Circuit-Switching Concepts* | *Logical Link Control- LLC-* |
| S-3 | SLO-1 | *UDP Overview* | *Transmission Impairments* | *Flow Control* | *Packet-Switching Principles* | *Protocol- BRIDGES* |
| | SLO-2 | *TCP/IP Applications* | *Attenuation And Attenuation Distortion* | *Stop-And-Wait Flow Control* | *Advantage of Packet Switching* | *Functions Of A Bridge* |
| S 4-7 | SLO-1 | *Laboratory 1: Familiarization with configuring and installing a LAN using packet tracer* | *Laboratory 4: To study different types of transmission media* | *Laboratory 7: Error Detecting Code Using CRC-CCITT (16-bit)- Java /C/C++ Program* | *Laboratory 10:Study of switches, bridges using Cisco packet tracer* | *Laboratory 13: Designing various topologies using cisco packet tracer* |
| | SLO-2 | | | | | |
| S-8 | SLO-1 | *The OSI Model* | *Delay Distortion* | *Stop-And-Wait Flow Control Delay Distortion* | *Comparison Of Circuit Switching And Packet Switching,X.25* | *Fixed Routing- The Spanning Tree Approach- Frame Forwarding-* |
| | SLO-2 | *Role play and activity based learning for understanding OSI model, Standardization within a Protocol* | *Noise, Guided Transmission Media* | *Error Control* | *Frame Relay- Background* | *Electronic Mail* |

| Duration (hour) | | 21 | 21 | 21 | 21 | 21 |
|---|---|---|---|---|---|---|
| S-9 | SLO-1 | *Architecture - Standardization within the OSI Framework, Service Primitives and* | *Twisted Pair-Physical Description-Applications-Unshielded And Shielded Twisted Pair* | *Stop-And-Wait ARQ* | *Frame Relay Protocol Architecture-User Data Transfer* | *SMTP And MIME- Simple Mail Transfer Protocol (SMTP* |
| | SLO-2 | *Parameters- Traditional Internet-Based Applications Multimedia-Media Types* | *Coaxial Cable- Physical Description-Applications-Transmission Characteristics* | *Go-Back-N ARQ HDLC* | *Routing In Switched Networks* | *Basic Electronic Mail Operation* |
| S-10 | SLO-1 | *Multimedia Applications, Standardization within a Protocol* | *Optical Fiber- Physical Description Applications-Transmission Characteristics* | *High-Level Data Link Control (HDLC)* | *Routing Strategies* | *SMTP Overview- Connection Setup-* |
| | SLO-2 | *Architecture Standardization within the OSI Framework* | *Noise- Guided Transmission Media Wireless Transmission* | *Basic Characteristics Frame Structure* | *Fixed Routing Flooding* | *Mail Transfer* |
| S 11-14 | SLO-1 | *Laboratory 2: Experimenting with network protocols for achieving communication between computers using packet tracer* | *Laboratory 5: Interconnection software for communication between two different network architectures-using packet tracer* | *Laboratory 8: Case study submission for: Sliding-Window Flow Control & Stop-And-Wait Flow Control* | *Laboratory 11:To configure network security using two routers by blocking ICMP ping request.-CISCO packet tracer* | *Laboratory 14 :To configure Internet Access/Implementation using CISCO packet tracer* |
| | SLO-2 | | | | | |
| S-15 | SLO-1 | *Service Primitives Parameters* | *Antennas-Transmission Media control* | *Address Field- Data Field* | *Random Routing Switched Networks* | *Multipurpose Internet Mail Extensions (MIME) Benefits MIME* |
| | SLO-2 | *Internet based* | *Wireless connection* | *Basic Characteristics data* | *Example* | *Advantage MIME* |
| S-16 | SLO-1 | *Traditional Internet-Based Applications* | *Terrestrial Microwave- Physical Description-Applications* | *Control Field* | *Adaptive Routing* | *Messages transmission* |
| | SLO-2 | *Introduction of network layers* | *Feature of Optical Fiber* | *Error - detection* | *Hub, switch* | *Request Messages* |
| S-17 | SLO-1 | *OSI reference model* | *Feature of Transmission Media* | *Error Correction- code* | *Repeater* | *Response Messages* |
| | SLO-2 | *Layers in the OSI Model, Comparison of Layers* | *Advantage coaxial cable* | *Over view of Frame work Advantage frame work* | *Gateway routers* | *Protocol Architecture Bridge Protocol Architecture* |
| S 18-21 | SLO-1 | *Laboratory 3:Creating a LAN using packet tracer* | *Laboratory 6: Using packet tracer to connect a network with different types of media connection* | *Laboratory 9: SIMULATION OF STOP AND WAIT PROTOCOL using NS/2 or any other tool* | *Laboratory 12: Case study submission for routing* | *Laboratory 15:Web programming using HTML* |
| | SLO-2 | | | | | |

| | | |
|---|---|---|
| **Learning Resources** | 1. "Data And Computer Communications" - William Stallings -Eighth Edition<br>2. BehrouzA.Forouzan,(2010), "Data Communications and Networking", 5th Edition | 3. "DataCommunicationsandNetworking"BehrouzA.Forouzan,"5thedition,July1,2010,ISBN:9780073376226<br>4. WilliamStallings,(2010), "Data and Computer Communications", Ninth Edition |

**Learning Assessment**

| Bloom's Level of Thinking | | Continous Learning Assessment(50% Weightage) | | | | | | | | Final Examination (50% weightage) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4# (10%) | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100% | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

| Course Designers | | |
|---|---|---|
| **Experts from Industry** | **Experts from Higher Technical Institutions** | **Internal Experts** |
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr. S. Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | Dr. Sabeen<br>Dr. Arul Leena Rose |

| Course Code | PCS21E01J | Course Name | ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS | Course Category | D | Discipline Elective Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 | 0 | 2 | 4 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to, | Learning | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) |
| CLR-1 : | *Gain knowledge about Artificial Intelligence(AI) and Heuristic search technique* | | | |
| CLR-2 : | *Gain knowledge about Knowledge representations and Predicate logic* | | | |
| CLR-3 : | *Understand Machine Learning and concept learning, Develop a Learning System* | | | |
| CLR-4 : | *Understand and Apply real time problem using Artificial Intelligence* | | | |
| CLR-5 : | *Practice the Machine Learning Models* | | | |
| CLR-6 | *Understand the Decision tree and , Neural Network and Genetic algorithm* | | | |

| Course Learning Outcomes (CLO): | At the end of this course, learners will be able to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Disciplinary Knowledge | Critical Thinking | Problem Solving | Analytical Reasoning | Research Skills | Team Work | Scientific Reasoning | Reflective Thinking | Self-Directed Learning | Multicultural Competence | Ethical Reasoning | Community Engagement | PSO 1 | PSO 2 | PSO 3 |
| CLO-1 : | *Have an understanding of AI and its challenges* | 3 | 80 | 70 | L | H | - | H | L | - | - | | | | | | | | - |
| CLO-2 : | *Apply predicate logic for problem solving* | 3 | 85 | 75 | M | H | L | M | L | - | - | | | | | | | | - |
| CLO-3 : | *Understand the various learning methods and their applications* | 3 | 75 | 70 | M | H | M | H | L | - | - | | | | | | | | - |
| CLO-4 : | *Have a thorough understanding of various ML algorithms* | 3 | 85 | 80 | M | H | M | H | L | - | - | | | | | | | | - |
| CLO-5 : | *Clear understanding of the fundamentals of Neural Networks* | 3 | 85 | 75 | H | H | M | H | L | - | - | | | | | | | | - |
| CLO-6 | *Apply ML for solving real-life problems* | 3 | 85 | 80 | L | H | H | H | H | - | - | | | | | | | | - |

| Duration(Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Introduction to AI* | *Problem-Solving Agents* | *Hill-climbing search* | *Learning and Forms of Learning* | *Expert systems:- Introduction* |
| | SLO-2 | *Goal and Philosophy of AI* | *Toy Problem* | *Simulated annealing search* | *Inductive Learning* | *Basic concepts in Expert System* |
| S-2 | SLO-1 | *Sub areas of AI,applications* | *Some real world problems* | *Local Beam Search* | *Learning Decision Trees* | *Structure of expert systems.* |
| | SLO-2 | *AI Techniques* | *Searching for Solutions* | *Genetic Algorithms* | *Ensemble Learning* | *The human element in expert systems how expert systems works,* |
| S-3 | SLO-1 | *Applications of AI* | *Breadth-first search* | *Knowledge Based Agents* | *Computational Learning Theory* | *Problem areas addressed by expert systems* |
| | SLO-2 | *History of AI* | *Depth-first search* | *Propositional Logic Introduction* | *Examples and Hypothesis in Learning* | *expert systems success factors* |
| S-4 to S-5 | SLO-1 | *Lab 1 : AI Techniques implementation* | *Lab : 4 Knowledge implementation* | *Lab : 7 Concept Learning task* | *Lab : 10 Decision tree implementation* | *Lab : 13 Neural Network model implementation* |
| S-6 | SLO-1 | *Types of Intelligence* | *Depth-limited search* | *Propositional Logic Semantics* | *Knowledge in Learning* | *Types of expert systems* |
| | SLO-2 | *Inductive and Deductive Reasoning* | *Iterative deepening depth-first search* | *Reasoning Patterns in Propositional Logic* | *Explanation based learning* | *Expert systems and the web* |
| S-7 | SLO-1 | *Human Vs Machine Intelligence* | *Bidirectional search* | *Forward and Backward Chaining* | *Learning used Relevant Information* | *Knowledge engineering and scope of knowledge* |
| | SLO-2 | *Agents and Environments* | *Comparing uninformed search strategies* | *Agents Based on Proportional Logic* | *Inductive Logic Programming* | *Difficulties, in knowledge acquisition methods of knowledge acquisition* |
| S-8 | SLO-1 | *Concept of Rationality* | *Avoiding Repeated States* | *First-Order Logic Intro* | *Learning with Hidden Variables* | *Machine learning, and intelligent agents,* |

| Duration(Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| | SLO-2 | *Structure of Agents* | *Searching with Partial Information* | *Models for first-order logic* | *The EM Algorithm* | *Selecting an appropriate knowledge acquisition method* |
| S-9 to S-10 | SLO-1 | *Problem solving Agents* | *Lab : 5 Implementations of FOPL and Rules* | *Lab : 8 Design a Learning System* | *Lab : 11 Implementation of Decision tree and K- Mean algorithm* | *Lab : 14 Implementation of Multi-layer neural network* |
| S-11 | SLO-1 | *The Nature of Environments* | *Informed (Heuristic) Search Strategies* | *Symbols and interpretations for first-order logic* | *Instance Based Learning* | *Societal impacts reasoning in artificial intelligence,* |
| | SLO-2 | *Agent Programs* | *Greedy best-first search* | *Terms for first-order logic* | *Introduction to Neural Networks* | *Inference with rules, with frames* |
| S-12 | SLO-1 | *Simple reflex agents* | *A* search* | *Atomic sentences in First Order Logic* | *Single layer feed-forward neural networks* | *Model based reasoning,* |
| | SLO-2 | *Model-based reflex agents* | *Memory-bounded heuristic search* | *Assertions and queries in first-order logic* | *Multi layered feed-forward neural networks* | *Case based reasoning,* |
| S-13 | SLO-1 | *Goal-based agents* | *The effect of heuristic accuracy on performance* | *Knowledge Engineering in First-Order Logic* | *Reinforcement Learning* | *Explanation & meta knowledge* |
| | SLO-2 | *Utility-based agents* | *Inventing admissible heuristic functions* | *Propositional vs. First-Order Inference* | *Passive and Active Reinforcement Learning* | *Meta knowledge inference with uncertainty representing uncertainty* |
| S-14 to S-15 | SLO-1 | *Lab 3 : Implementation of intelligent agents* | *Lab : 6 Implementation of Ontology and FOL* | *Lab : 9 Implementation of candidate elimination algorithm* | *Lab : 12 Implementation of ID3 algorithm* | *Lab : 15 Applying Backpropagation and genetic algorithm* |

| **Learning Resources** | 1. Rich Elaine & Kevin Knight – Artificial Intelligence – Tata McGraw Hill -1993<br>2. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997. (Chapters : 1, 2, 3, 4, 8 and 9) | 3. Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Datall, First Edition, Cambridge University Press, 2012.<br>4. Stephen Marsland, ―Machine Learning –An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014. |
|---|---|---|

**Learning Assessment**

| Bloom's Level of Thinking | | Continous Learning Assessment(50% Weightage) | | | | | | | | Final Examination (50% weightage) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4# (10%) | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100% | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

| **Course Designers** | | |
|---|---|---|
| **Experts from Industry** | **Experts from Higher Technical Institutions** | **Internal Experts** |
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr. S. Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | Dr. Sweety Bakyarani. E |
| | | Dr. Sabeen |

| Course Code | PCS21E02J | Course Name | CLOUD COMPUTING | Course Category | D | Discipline Elective Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 | 0 | 2 | 4 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Fundamental Knowledge | Application of Concepts | Link with Related Disciplines | Procedural Knowledge | Skills in Specialization | Ability to Utilize Knowledge | Skills in Modeling | Analyze, Interpret Data | Investigative Skills | Problem Solving Skills | Communication Skills | Analytical Skills | PSO 1 | PSO 2 | PSO 3 |
| CLR-1 : | *Understand and Analyze the cost metrics, handle the security threats and construct different cloud delivery design models* | | | | | | | | | | | | | | | | | | |
| CLR-2 : | *understand the architecture of cloud* | | | | | | | | | | | | | | | | | | |
| CLR-3 : | *understand the need for virtualization* | | | | | | | | | | | | | | | | | | |
| CLR-4 : | *the concepts behind scheduling and load balancing that is happening across heterogeneous resources in the environment* | | | | | | | | | | | | | | | | | | |
| CLR-5 : | *justify the need for improved hardware and software infrastructures (servers, protocols, security algorithms)* | | | | | | | | | | | | | | | | | | |
| CLR-6 : | *know the commercial functioning of cloud computing* | | | | | | | | | | | | | | | | | | |
| **Course Learning Outcomes (CLO):** | At the end of this course, learners will be able to: | | | | | | | | | | | | | | | | | | |
| CLO-1 : | *defend the need for cloud computing to run an online business* | 3 | 80 | 70 | L | H | - | H | L | - | - | - | | | | | | - | - |
| CLO-2 : | *understand and figure out the necessities of middleware technologies* | 3 | 85 | 75 | M | H | L | M | L | - | - | - | | | | | | - | - |
| CLO-3 : | *practically create a virtual environment (lab purpose using VMware)* | 3 | 75 | 70 | M | H | M | H | L | - | - | - | | | | | | - | - |
| CLO-4 : | *implement cryto algorithms that may be used in the computing environment* | 3 | 85 | 80 | M | H | M | H | L | - | - | - | | | | | | - | - |
| CLO-5 : | *Learn cloud enabling technologies and its applications* | 3 | 85 | 75 | H | H | M | H | L | - | - | - | | | | | | - | - |
| CLO-6 : | *Commercial functioning* | 3 | 80 | 70 | L | H | - | H | L | - | - | - | | | | | | - | - |

| Duration (Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Introduction to Networking* | *Roles and Boundaries* | *Cloud Computing Applications: Cloud for Health care, Energy systems, Transportation systems* | *Cloud Usage Monitor , Resource Replication ,Ready-Made environment* | *Fundamental Cloud Security: Threat Agents* |
| | SLO-2 | *Data Communication* | *Cloud Characteristics* | *Manufacturing Industry, Government, Education and Mobile Communication* | *Specialized Cloud Mechanisms* | *Cloud Security Threats* |
| S-2 | SLO-1 | *Cloud computing* | *Cloud Delivery models* | *Cloud Computing Mechanisms: Logical Network Perimeter, Virtual server: Cloud Storage device* | *Load Balancer, SLA Monitor, Hypervisor, Resource Cluster* | *Single –sign on :Kerberos Identification* |
| | SLO-2 | *Origin of Cloud Computing* | *Cloud Deployment models* | *Fundamental Cloud Architectures* | *Cloud Management Mechanisms: Remote Administration systems* | *One-time Password, Basic Cloud data Security mechanisms* |
| S-3 | SLO-1 | *Basic Concepts of Cloud Computing* | *Cloud Enabling Technology and Applications* | *Design Approaches with case Study* | *SLA Management System* | *Advanced Cloud* |
| | SLO-2 | *Basic Concepts and Terminology* | *Broadband Network and Internet Architecture* | *Design Methodology for IaaS Service* | *Resource Management System, Billing Management system* | *Mobile Cloud* |
| S 4-5 | SLO-1 | *Laboratory 1: Create a virtual machine* | *Laboratory 4: Create GAE Launcher* | *Laboratory 7:Encryption and Decryption of Text* | *Laboratory 10: Security mechanisms: Encryption :Hashing: Digital Signature* | *Laboratory 13: Create a Warehouse Application in Sales force.Com* |
| | SLO-2 | | | | | |
| S-6 | SLO-1 | *Goals and Benefits* | *Data Center Technology, Virtualization Technology* | *Design Methodology for PaaS Service* | *Cost Metrics and Pricing Models: Business Cost Metrics, Cloud Usage cost metrics* | *Green Cloud* |

| Duration (Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| | SLO-2 | *Risks and Challenges* | *Web Technology ,Multitenant Technology* | *Study of Saas Service Model* | *Service Quality Metrics ,SLA Guidelines* | *Media Cloud* |
| S-7 | SLO-1 | *Introduction to virtualization* | *Include –v Flag* | *Basis of SaaS* | *Security Cloud : CIA Concept* | *Specific Cloud Services Models* |
| | SLO-2 | | | | | |
| S-8 | SLO-1 | *Types of Virtual Machines* | *Viewing your application* | *Advantages of SaaS* | *Types of Security Attacks* | *Basic Terms and Conditions- Cloud* |
| | SLO-2 | | | | | |
| S9-10 | SLO-1 | *Laboratory 2: Install a C compiler in the virtual machine created using virtual box and execute SimplePrograms* | *Laboratory :5 Client Server communication between two virtual machine instances, execution of chat application* | *Laboratory 8: Simple Experiments in Cloud Sim* | *Laboratory 11: Simple Experiments in Cloud Sim* | *Laboratory 14: Create a Warehouse Application in Sales force.Com using Apex prog Lang* |
| | SLO-2 | | | | | |
| S-11 | SLO-1 | *Install virtual box* | *Implement two host operating systems onto a single virtual box* | *Brief Introductory part of software as a service* | *Security Policy Implementation* | *Resource allocation in cloud computing* |
| | SLO-2 | | | | | |
| S-12 | SLO-1 | *Download Linux* | *Run the virtual machines* | *Saas : Unification Technologies* | *Security Policy Implementation : Policy Types* | *Introduction* |
| | SLO-2 | | | | | |
| S-13 | SLO-1 | *How to install Virtual box* | *Open terminal in one VM, give ifconfig command* | *Saas :Integrated Products* | *Techniques to Secure Data* | *Importance of Cloud Computing* |
| | SLO-2 | *How to install Linux os* | *Then ping the Ip of one machine in the other terminal,ping 10.0.2.10* | *Saas product selection criteria* | *Cloud Encryption* | *Strategies for Resource Allocation* |
| S14-15 | SLO-1 | *Laboratory 3: Installing C environment* | *Laboratory 6: Then run the communication between the terminals* | *Laboratory 9: Saas Integration services* | *Laboratory 12: Symmetric Encryption* | *Laboratory 15: Resource Allocation Policies and Algorithms* |
| | SLO-2 | *Install Linux using Virtual box* | *Create a cloudlet* | *Infrastructure as a Service* | *Cloud Security Alliance* | *Performance-based RAS* |

| | | |
|---|---|---|
| **Learning Resources** | 1. Thomas Erl, ZaighamMahmood,RichardoPuttini, "Cloud Computing: Concepts,Technology& Architecture", Fourth Printing, Prentice Hall/PearsonPTR, 2014,ISBN: 780133387520.<br>2. ArshdeepBahga, Vijay Madisetti, "Cloud Computing: A Hands-On Approach", University Press, 2016, ISBN: 9780996025508. | 3. K.Chandrasekaran, "Essentials of Cloud Computing", Chapman and Hall/CRC Press, 2014, ISBN 9781482205435.<br>4. Thomas Erl, Robert Cope, Amin Naserpour, "Cloud Computing Design Patterns",Prentice Hall/Service Tech Press, Pearson, 2015, ISBN: 978-0133858563. |

**Learning Assessment**

| Bloom's Level of Thinking | | Continuous Learning Assessment (50% weightage) | | | | | | | | Final Examination (50% weightage) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4 (10%)# | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100% | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

**Course Designers**

| Experts from Industry | Experts from Higher Technical Institutions | Internal Experts |
|---|---|---|
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr.S.Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | Dr. P.Muthulakshmi |
| | | Mrs. E. Aarthi |

| Course Code | PCS21E03J | Course Name | IMAGE PROCESSING USING MATLAB | Course Category | D | Discipline Elective Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 | 0 | 2 | 4 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Fundamental Knowledge | Application of Concepts | Link with Related Disciplines | Procedural Knowledge | Skills in Specialization | Ability to Utilize Knowledge | Skills in Modeling | Analyze, Interpret Data | Investigative Skills | Problem Solving Skills | Communication Skills | Analytical Skills | PSO 1 | PSO 2 | PSO 3 |
| CLR-1 : | *To provide deep understanding of basic concept of digital image acquisition* | | | | | | | | | | | | | | | | | | |
| CLR-2 : | *To provide deep Understanding of various digital image enhancement techniques* | | | | | | | | | | | | | | | | | | |
| CLR-3 : | *To Understand image restoration and segmentation methods* | | | | | | | | | | | | | | | | | | |
| CLR-4 : | *To provide understanding and implementation of image compression techniques* | | | | | | | | | | | | | | | | | | |
| CLR-5 : | *To provide understanding and knowledge of image recognition methods* | | | | | | | | | | | | | | | | | | |
| **Course Learning Outcomes (CLO):** | At the end of this course, learners will be able to: | | | | | | | | | | | | | | | | | | |
| CLO-1 : | *Understand basics of digital images and tools for image processing* | 3 | 80 | 70 | L | H | - | H | L | - | - | - | | | | | - | - | - |
| CLO-2 : | *Learn and implement image Enhancement techniques* | 3 | 85 | 75 | M | H | L | M | L | - | - | - | | | | | - | - | - |
| CLO-3 : | *Understand and Learn image Restoration and Segmentation Methods* | 3 | 75 | 70 | M | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-4 : | *Understand and implement Image Compression techniques* | 3 | 85 | 80 | M | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-5 : | *Learn and Implement Image Recognition methods* | 3 | 85 | 75 | H | H | M | H | L | - | - | - | | | | | - | - | - |

| Duration (Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Introduction of Digital Image Processing* | *Introduction to Spatial Domain* | *Point detection* | *Fundamentals of Compression* | *Boundary representation- Chain codes* |
| | SLO-2 | *Origin-Steps in Digital Image Processing* | *Smoothing frequency* | *Line Detection* | *Image Compression methods* | *Polygonal approximation* |
| S-2 | SLO-1 | *Fundamental steps in Digital Image Processing* | *Domain filters* | *Edge Detection* | *Error Free* | *Signature* |
| | SLO-2 | *Image Sensing and Acquisition* | *Sharpening frequency domain filters* | *Local & Regional processing* | *Compression* | *Patterns and Pattern classes* |
| S-3 | SLO-1 | *Image Sampling* | *The 2-D Discrete Fourier Transform* | *Region based segmentation* | *Variable Length Coding* | *Boundary description–Shape number* |
| | SLO-2 | *Quantization* | *Noise models* | *Morphological processing* | *Arithmetic coding* | *Regional Descriptors* |
| S4-5 | SLO-1 | *Laboratory 1: Image Sensing and Acquisition, Image Sampling and Quantization* | *Laboratory4: Smoothing and Sharpening Spatial Filtering, Frequency Domain: Basics of filtering* | *Laboratory 7:Marr-Hildreth & Canny edge detector* | *Laboratory 10: Compression Standards-Huffman, Arithmetic coding, LZW coding* | *Laboratory 13: Regional Descriptors, Topological -Texture –Patterns and Pattern classes* |
| | SLO-2 | | | | | |
| S-6 | SLO-1 | *Components* | *Computing and Visualizing the 2-D DFT in MATLAB* | *Watershed segmentation algorithm* | *Lossy Compression* | *Fourier Descriptor* |
| | SLO-2 | *Elements of Visual Perception* | *Filtering in the Frequency Domain* | *Boundary detection* | *Lossy Predictive Coding* | *Topologica* |
| S-7 | SLO-1 | *The MATLAB Working Environment* | *Properties of 2D Fourier Transform* | *Spatial Filters.* | *Block Transform coding, JPEG standard* | *Recognition based on matching* |
| | SLO-2 | *Exploring functions* | *Mean Filters orders* | *Image Enhancement in Frequency domain* | *Huffman coding* | *Texture* |

| Duration (Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| S-8 | SLO-1 | *Relationships between pixels* | *Statistics* | *Image Enhancement in Frequency domain* | *MATLAB code for image compression: Arithmetic coding* | *MATLAB code for image representation* |
| | SLO-2 | *Background on MATLAB* | *Adaptive filters* | *Filtering in the frequency domain* | *Run Length Encoding* | *Image recognition* |
| S9-10 | SLO-1 | *Laboratory 2: Introduction to Image processing toolbox in MATLAB* | *Laboratory 5: MATLAB code for histogram, equalization* | *Laboratory 8: Edge Linking and Boundary detection* | *Laboratory 11: Run Length Encoding Compression Standards Huffman,* | *Laboratory 14: MATLAB code for image recognition, MATLAB Practice exercises* |
| | SLO-2 | | | | | |
| S-11 | SLO-1 | *Image Processing Toolbox* | *Band reject Filters* | *Smoothing* | *Bit plane Coding* | *Region based Segmentation* |
| | SLO-2 | *Gray level transformations* | *Band pass Filters* | *Sharpening* | *Compression Standards Huffman* | *Compression* |
| S-12 | SLO-1 | *Histogram processing* | *Inverse Filtering* | *Edge detection operators* | *Predictive coding* | *Edge Detection* |
| | SLO-2 | *Smoothing and Sharpening Spatial Filtering* | *Wiener filtering* | *Degradation using adaptive and wiener filter* | *boundary segments* | *Transformations* |
| S-13 | SLO-1 | *Frequency Domain: Basics of filtering* | *Segmentation* | *Wavelets–Sub band coding* | *Wavelet coding* | *Thresholding* |
| | SLO-2 | *Basics of Spatial Filtering* | *frequency domain filters* | *Multi resolution expansions* | *MPEG standards* | *Boundary Segments* |
| S 14-15 | SLO-1 | *Laboratory3: Toolbox practice* | *Laboratory6: MATLAB code for spatial and frequency domain filters.* | *Laboratory 9: MATLAB code for restoring an image after Degradation using adaptive and wiener filter, Edge detection operators* | *Laboratory12: MATLAB code for image compression: Huffman coding, Arithmetic coding,* | *Laboratory 15:Case study using MATLAB* |
| | SLO-2 | | | | | |

| | |
|---|---|
| **Learning Resources** | 1.Digital Image Processing Using MATLAB, Ralph Gonzalez, Richard Woods, Steven Eddins, Second Edition,2017, Kindle<br>2. A Practical Approach for Image Processing & Computer Vision In MATLAB, Prof. Neeraj Bhargava, Dr. Ritu Bhargava, Abhishek Pandey, CreateSpace Independent Publishing Platform ,2016. |

**Learning Assessment**

| Bloom's Level of Thinking | | Continous Learning Assessment(50% Weightage) | | | | | | | | Final Examination (50% weightage) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4# (10%) | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100% | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc

**Course Designers**

| Experts from Industry | Experts from Higher Technical Institutions | Internal Experts |
|---|---|---|
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr.S.Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | Dr.Arul Leena Rose |
| | | Dr.Sabeen |

| Course Code | PCS21S01J | Course Name | INFORMATION LITERACY | Course Category | S | Skill Enhancement Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 1 | 0 | 2 | 2 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: |
|---|---|
| CLR-1 : | *To recognize when information is needed.* |
| CLR-2 : | *To Understand the economic, legal, and social issues surrounding the use of information ethically and legally* |
| CLR-3 : | *To have the ability to locate evaluate and use effectively.* |
| CLR-4 : | *To use the research tool as per their study* |

| Course Learning Outcomes (CLO): | At the end of this course, learners will be able to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Fundamental Knowledge | Application of Concepts | Link with Related Disciplines | Procedural Knowledge | Skills in Specialization | Ability to Utilize Knowledge | Skills in Modeling | Analyze, Interpret Data | Investigative Skills | Problem Solving Skills | Communication Skills | Analytical Skills | PSO 1 | PSO 2 | PSO 3 |
| CLO-1 : | *Analyze a research need* | 3 | 80 | 70 | L | H | - | H | L | - | - | - | | | | | - | - | - |
| CLO-2 : | *Find information effectively and efficiently by using a variety of search techniques* | 3 | 85 | 75 | M | H | L | M | L | - | - | - | | | | | - | - | - |
| CLO-3 : | *Access needed information in multiple publication formats* | 3 | 75 | 70 | M | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-4 : | *Evaluate the quality and relevance of information sources* | 3 | 85 | 80 | M | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-5 : | *Recognize several ethical and legal issues related to the use of information* | 3 | 85 | 75 | H | H | M | H | L | - | - | - | | | | | - | - | - |

| Duration (Hour) | | 9 | 9 | 9 | 9 | 9 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *An introduction to Information literacy* | *special interest organizations* | *Control Structures* | *Multilple media, Input functions* | *Arithmetic, relational and logical operations on matrices.* |
| | SLO-2 | *understanding practical aspects of information literacy such as Matlab Environment* | *media* | *For loop* | *Output functions* | *Polynomial evaluations, roots of polynomial and arithmetic operations on polynomials.* |
| S-2-3 | SLO-1 | *Laboratory 1: practice simple program using matlab* | *Laboratory 3: write a program involving data types and constants.* | *Laboratory 5: write a program using for loop and while loop.* | *Laboratory 7: write a program to demonstrate the functions of break statement.* | *Laboratory 9: write a program to plot 2d graphs.* |
| | SLO-2 | | | | | |
| S-4 | SLO-1 | *Getting familiarized with command window* | *Data types* | *While loop* | *Reading data* | *Graphics: 2D plots* |
| | SLO-2 | *Libraries* | *Constants* | *Do - while* | *Storing data* | *Printing labels* |
| S-5-6 | SLO-1 | *Community resources* | *Variables* | *If control structures* | *Vectors* | *Grid & Axes box* |
| | SLO-2 | *Current directory* | *Character constants* | *Switch* | *Graphical, aural, textual* | *Text in plot* |
| S7 | SLO-1 | *Figure Window* | *Operators* | *Break* | *commands to operate on vectors and matrices* | *Bar chart* |
| | SLO-2 | *Edit Window* | *Assignment statements* | *Continue statement* | *matrix Manipulations* | *Pie chart* |
| S8-9 | SLO-1 | *Laboratory 2: write a simple program in matlab using the basic tools.* | *Laboratory 4: write a program using variables and operators.* | *Laboratory 6: write a program to demonstrate the functions of switch case statement.* | *Laboratory 8: write a program to demonstrate the commands operated on vectors.* | *Laboratory 10: write a program to demonstrate pie chart and bar chart.* |
| | SLO-2 | | | | | |

| | |
|---|---|
| **Learning Resources** | Bansal R.K, Goel A.K., Sharma M.K., "MATLAB and its Applications in Engineering", Pearson Education, 2012. |

| **Learning Assessment** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Bloom's Level of Thinking** | **Continuous Learning Assessment (100% weightage)** | | | | | | | |
| | | **CLA – 1 (20%)** | | **CLA – 2 (20%)** | | **CLA – 3 (30%)** | | **CLA – 4# (30%)** | |
| | | **Theory** | **Practice** | **Theory** | **Practice** | **Theory** | **Practice** | **Theory** | **Practice** |
| Level 1 | Remember | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% |
| | Understand | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | |
| Level 3 | Evaluate | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Create | | | | | | | | |
| | Total | 100% | | 100% | | 100% | | 100 % | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

| **Course Designers** | | |
|---|---|---|
| **Experts from Industry** | **Experts from Higher Technical Institutions** | **Internal Experts** |
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr. S. Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | 1. Dr.Arul Leena Rose<br>2. Dr.Sweety |

| Course Code | PCD21AE1T | Course Name | PROFESSIONAL SKILLS AND PROBLEM SOLVING | Course Category | A | Ability Enhancement Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 1 | 0 | 0 | 1 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Career Development Centre | | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: | Learning | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) |
| CLR-1: | *Utilise success habits to enhance professionalism* | | | |
| CLR-2: | *Enable to solve problems and to crack competitive exams.* | | | |
| CLR-3: | *Understand and master the mathematical concepts to solve types of problem* | | | |
| CLR-4: | *Identify a logically sound and well-reasoned argument* | | | |
| CLR-5: | *Expertise in communication and problem-solving skills* | | | |
| CLR-6: | *Develop problem solving skills with appropriate strategies* | | | |

| Course Learning Outcomes (CLO): | At the end of this course, learners will be able to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Disciplinary Knowledge | Critical Thinking | Problem Solving | Analytical Reasoning | Research Skills | Team Work | Scientific Reasoning | Reflective Thinking | Self-Directed Learning | Multicultural Competence | ICT Skills | Life Long Learning | PSO - 1 | PSO - 2 | PSO - 3 |
| CLO-1: | *Identify success habits and inculcate professional skills* | 2 | 80 | 75 | H | H | H | H | H | H | | | | | | | | | |
| CLO-2: | *Grasp the approaches and strategies to solve problems with speed and accuracy* | 2 | 80 | 70 | H | L | H | H | H | H | | | | | | | | | |
| CLO-3: | *Collectively solve problems in teams and groups* | 2 | 75 | 70 | H | H | H | L | H | H | | | | | | | | | |
| CLO-4: | *Construe and solve an argument through critical thinking* | 2 | 80 | 75 | H | H | H | H | H | H | | | | | | | | | |
| CLO-5: | *Acquire communication and problem- solving skills* | 2 | 80 | 70 | H | H | M | H | H | H | | | | | | | | | |
| CLO-6: | *Apply problem solving techniques and skills* | 2 | 80 | 75 | H | H | H | H | M | H | | | | | | | | | |

| Duration (hour) | | 3 | 3 | 3 | 3 | 3 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Personal profiling* | *Creative problem solving method* | *Case study analysis* | *Emotional Intelligence* | *Communication skills* |
| | SLO-2 | *USP& Personal branding* | *Techniques* | *Case study analysis* | *Personal & social competence* | *Communication skills* |
| S-2 | SLO-1 | *Assumption and strengthening of an argument* | *Weakening and Inference of an argument* | *Conclusion and paradox of an argument* | *Main idea and structure of a passage* | *Tone and Style of a passage* |
| | SLO-2 | *Assumption and strengthening of an argument* | *Weakening and Inference of an argument* | *Conclusion and paradox of an argument* | *Main idea and structure of a passage* | *Tone and Style of a passage* |
| S-3 | SLO-1 | *Arithmetic: Simple equations* | *Profit, Loss & Discount* | *Average* | *Percentage* | *Mixtures &alligation* |
| | SLO-2 | *Equation 1 and equation 2* | *Interest calculation* | *Average* | *Percentage* | *Mixtures &alligation* |

| Learning Resources | |
|---|---|
| 1. Arun Sharma-Quantitative aptitude for CAT, Tata McGraw Hill<br>2. DineshKhattar-The Pearson Guide to QUANTITATIVE APTITUDE for competitive examinations. | 3. Manhatten Prep - GRE Reading Comprehension and Essays<br>4. Seven habits of highly effective people- Steven Covey<br>5. Manhattan Prep – Critical Reasoning Skills and Techniques |

| Learning Assessment | | | | | |
|---|---|---|---|---|---|
| Level | Bloom's Level of Thinking | Continuous Learning Assessment (100% weightage) | | | |
| | | CLA-1 (20%) | CLA-2 (20%) | CLA-3 (30%) | CLA-4 (30%) ## |
| | | Theory | Theory | Theory | Theory |
| Level 1 | Remember | 10% | 10% | 30% | 15% |
| | Understand | | | | |
| Level 2 | Apply | 50% | 50% | 40% | 50% |
| | Analyze | | | | |
| Level 3 | Evaluate | 40% | 40% | 30% | 35% |
| | Create | | | | |
| | Total | 100 % | 100 % | 100 % | 100 % |

**# CLA-1, CLA-2 and CLA-3 can be from any combination of these: Online Aptitude Tests, Classroom Activities, Case Studies, Poster Presentations, Power-point Presentations, Mini Talks, Group Discussions, Mock interviews, etc.**

**## CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,**

| Course Designers | |
|---|---|
| Experts from Industry | Internal Experts |
| 1. Ajay Zener, Director, Career Launcher | 1. Dr P Madhusoodhanan, HoD, CDC, E&T, SRMIST |
| | 2. Dr M Snehalatha, Assistant. Professor, CDC, E&T, SRMIST |

**SEMESTER-II**

| Course Code | PCS21C04J | Course Name | OPEN SOURCE TECHNOLOGIES | Course Category | C | Professional Core | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 | 0 | 4 | 5 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Engineering Knowledge | Problem Analysis | Design & Development | Analysis, Design, Research | Modern Tool Usage | Society & Culture | Environment & Sustainability | Ethics | Individual & Team Work | Communication | Project Mgt. & Finance | Life Long Learning | PSO - 1 | PSO - 2 | PSO – 3 |
| CLR-1: | *Lean Open Source Software* | | | | | | | | | | | | | | | | | | |
| CLR-2 : | *Designing web page using PHP* | | | | | | | | | | | | | | | | | | |
| CLR-3 : | *MYSQL Database* | | | | | | | | | | | | | | | | | | |
| CLR-4 : | *Database Applications using PHP with MYSQL* | | | | | | | | | | | | | | | | | | |
| CLR-5 : | *PERL* | | | | | | | | | | | | | | | | | | |
| CLR-6 : | *Advanced PERL* | | | | | | | | | | | | | | | | | | |
| **Course Learning Outcomes (CLO):** | At the end of this course, learners will be able to: | | | | | | | | | | | | | | | | | | |
| CLO-1 : | *Create a web page using OSS.* | 2 | 80 | 70 | L | H | - | H | L | - | - | - | | | | | - | - | - |
| CLO-2 : | *Design a web page using PHP* | 2 | 85 | 75 | M | H | L | M | L | - | - | - | | | | | - | - | - |
| CLO-3 : | *Design a web page using PHP with MYSQL* | 2 | 75 | 70 | M | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-4 : | *Web page with CMS* | 2 | 85 | 80 | M | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-5 : | *Web page using PERL commands* | 2 | 85 | 75 | H | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-6 : | *Understand Advanced PERL techniques* | 2 | 80 | 70 | L | H | - | H | L | - | - | - | | | | | - | - | - |

| Duration (Hour) | | 21 | 21 | 21 | 21 | 21 |
|---|---|---|---|---|---|---|
| S1 | SLO-1 | *PHP BASICS* | *Advanced PHP with MYSQL* | *Database* | *Scalar variables* | *PEARL* |
| | SLO-2 | *Introduction to PHP* | *Introduction to MYSQL* | *Database driven applications* | *Scalar operators* | *Advanced PERL* |
| S2 | SLO-1 | *Web Server* | *Exceptions* | *Sample applications* | *Functions* | *Directory Operations* |
| | SLO-2 | *Examples* | *Introduction* | *Advanced PHP with AJAX* | *Escape sequences* | *Process Management* |
| S3 | SLO-1 | *Apache Web Server* | *Error Handling* | *Advanced PHP with SEO* | *Lists* | *Process Communication* |
| | SLO-2 | *PHP-Data Types* | *Error Handling Functions* | *Advanced PHP with CMS* | *Arrays* | *String* |
| S4 -7 | SLO-1 | *Laboratory 1: COOKIES* | *Laboratory 4 : Sample Application using PHP MYSQL* | *Laboratory 7 : PHP with AJAX* | *Laboratory 10: String Operations in PERL* | *Laboratory 13: Process communication* |
| | SLO-2 | | | | | |
| S8 | SLO-1 | *Operators* | *Cookies Functions* | *CMS - Introduction* | *Subroutines* | *Advanced PERL Techniques* |
| | SLO-2 | *Expressions* | *Sessions* | *PHP with AJAX* | *Input Statements* | *File I/O* |
| S9 | SLO-1 | *Control Structures* | *Session Functions* | *AJAX Basics* | *Output Statements* | *Open a file* |
| | SLO-2 | *Functions* | *COM* | *PHP with Ajax Database driven applications* | *Hashes* | *Read from file* |

| Duration (Hour) | | 21 | 21 | 21 | 21 | 21 |
|---|---|---|---|---|---|---|
| S10 | SLO-1 | *Function Types* | *DOM* | *PHP with SEO* | *Hash Functions* | *Write to file* |
| | SLO-2 | *User Defined Functions* | *CURL* | *Basics SEO* | *Basic Input statement* | *File test* |
| S11-14 | SLO-1 | *Laboratory 2: SESSIONS* | *Laboratory 5: Exception Handling* | *Laboratory 8: Hash Implementation* | *Laboratory 11 : Sorting* | *Laboratory 14 : PERL Database Application* |
| | SLO-2 | | | | | |
| S15 | SLO-1 | *Functions Arrays* | *Example for Classes and Objects* | *Introduction Advantages* | *Examples using Hashes* | *Database Independent* |
| | SLO-2 | *Types of Arrays String Functions* | *Mail Functions Sample program using Mail Functions* | *Word Press – Introduction Blog - Introduction* | *Regular expressions* | *Perl – Sort Perl reverse sorting* |
| S16 | SLO-1 | *Date Functions* | *URL Functions* | *Simple webpage using CMS* | *Control structures* | *Complex sorting* |
| | SLO-2 | *Time Functions* | *Introduction to PHP with MYSQL* | *BASIC PERL* | *Modules in PERL* | *PERL – OOPS* |
| S 17 | SLO-1 | *Mathematical Functions* | *PHP and MYSQL functions* | *Introduction to PERL* | *Example using Regular expressions* | *Object* |
| | SLO-2 | *User Defined Functions* | *Database creation* | *Advantages of PERL* | *Example using control structure* | *Class* |
| S 18-21 | SLO-1 | *Laboratory 3: Shopping cart using PHP with MYSQL* | *Laboratory 6: String Functions* | *Laboratory 9: Array Implementation using PERL* | *Laboratory 12: Applications using Modules* | *Laboratory 15 : Advanced PERL techniques* |
| | SLO-2 | | | | | |

| **Learning Resources** | |
|---|---|
| | 1. Mehdi Achour, Friedhelm, Betz Antony Dovgal, Nuno Lopes, Hannes Magnusson, Georg Richter, Damien Seguy, JakubVrana And several others, (1997-2011), "PHP Manual (Download the manual from PHP official website www.php.net)", The PHP Documentation Group. (For Units I to III) |
| | 2. Lee Babin,(2007 ), "Beginning Ajax with PHP From Novice to Professional", Apres., (For Units IV to V ) |
| | 3. Jaimie Sirovich and Cristian Darie, (2007), "Professional Search Engine Optimization with PHP A Developer's Guide to SEO", Wiley Publishing, Inc., Indianapolis, Indiana. |
| | 4. Randal L. Schwartz, Tom Phoenix, brian d foy, "Learning Perl, Fifth Edition |

Learning Assessment

| Bloom's Level of Thinking | | Continous Learning Assessment(50% Weightage) | | | | | | | | Final Examination (50% weightage) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4# (10%) | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100% | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

| **Course Designers** | | |
|---|---|---|
| **Experts from Industry** | **Experts from Higher Technical Institutions** | **Internal Experts** |
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr.S.Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | Mrs.P.Yogalakshmi |
| | | Dr..S.Sabeen |

| Course Code | PCS21C05J | Course Name | DISTRIBUTED OPERATING SYSTEM | Course Category | C | Professional Core | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 | 0 | 4 | 5 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| CLR-1 : | *To strengthen the knowledge in Operating Systems.* | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Engineering Knowledge | Problem Analysis | Design & Development | Analysis, Design, Research | Modern Tool Usage | Society & Culture | Environment & Sustainability | Ethics | Individual & Team Work | Communication | Project Mgt. & Finance | Life Long Learning | PSO - 1 | PSO - 2 | PSO – 3 |
| CLR-2 : | *To examine the fundamental principles of distributed systems.* | | | | | | | | | | | | | | | | | | |
| CLR-3 : | *To comprehend about the communication that takes place in Distributed systems.* | | | | | | | | | | | | | | | | | | |
| CLR-4 : | *To realize the necessity of synchronization, consistency and Fault tolerance in a Distributed System.* | | | | | | | | | | | | | | | | | | |
| CLR-5 : | *To provide students hands-on experience in developing distributed protocols.* | | | | | | | | | | | | | | | | | | |
| CLR-6 : | *To acquire apparent scheme regarding distributed object-oriented based systems.* | | | | | | | | | | | | | | | | | | |
| **Course Learning Outcomes (CLO):** | At the end of this course, learners will be able to: | | | | | | | | | | | | | | | | | | |
| CLO-1 : | *Categorize layered protocols and comprehend the communications in distributed systems.* | 2 | 80 | 70 | H | H | H | H | H | | | | | | | | | | |
| CLO-2 : | *List the principles of distributed systems and describe the problems and challenges associated with these principles.* | 3 | 85 | 75 | H | H | H | H | H | | | | | | | | | | |
| CLO-3 : | *Understand Distributed Computing techniques, Synchronous and Processes.* | 3 | 75 | 70 | H | H | H | H | H | | | | | | | | | | |
| CLO-4 : | *Understand Distributed File Systems and Distributed Shared Memory.* | 3 | 85 | 80 | H | H | H | H | H | | | | | | | | | | |
| CLO-5 : | *Apply Distributed web-based system.* | 3 | 85 | 75 | H | H | H | H | H | | | | | | | | | | |
| CLO-6 : | *Understand the importance of security in distributed systems.* | 3 | 80 | 70 | H | H | H | H | H | | | | | | | | | | |

| Duration (Hour) | | 21 | 21 | 21 | 21 | 21 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Introduction: Overview of operating system concepts* | *Synchronization in distributed systems* | *Distributed File Systems: Introduction* | *Resource Management in DOS* | *Distributed Web-based Systems* |
| | SLO-2 | *Process management* | *Clock synchronization and related algorithms* | *Features and goal of distributed file system* | *Types of resources* | *Architecture, Processes* |
| S2 | SLO-1 | *Scheduling: CPU Scheduling* | *Events, Time in distributed systems* | *File models* | *Issues of resource sharing* | *Communication, Naming* |
| | SLO-2 | *Disk Scheduling* | *Concurrency control mechanism in DOS* | *File sharing semantics* | *Task assignment* | *Synchronization* |
| S3 | SLO-1 | *Memory management* | *Mutual exclusion in distributed environment* | *File caching scheme* | *Types of Distributed Load Balancing Algorithms* | *Consistency and Replication* |
| | SLO-2 | *Device and File management* | *Deadlock in distributed systems* | *File replication, Fault tolerance* | *Load estimation policy, Process transfer* | *Web Proxy Caching* |
| S4 – S7 | SLO-1 | *Laboratory 1:Virtual Machines, System Design And Implementation* | *Laboratory 4: Program to implement locking algorithm.* | *Laboratory 7: Implement Network File System* | *Laboratory 10: Implement Load Balancing Algorithm* | *Laboratory 13: Study of Web Service Programming* |
| | SLO-2 | | | | | |
| S8 | SLO-1 | *Introduction to distributed Systems, Definition and goals* | *Transactions in distributed environment* | *Fault tolerance, Trends in Distributed File System* | *Location policy, State information exchange policy* | *Replication for Web Hosting Systems* |
| | SLO-2 | | | | | |

| Duration (Hour) | | 21 | 21 | 21 | 21 | 21 |
|---|---|---|---|---|---|---|
| S9 | SLO-1 | *Hardware and Software Concepts* | *Processes and processors in distributed systems:* | *Distributed Shared Memory: Introduction* | *Priority assignment policy* | *Replication of Web Applications* |
| | SLO-2 | *Design Issues* | *Threads* | *General architecture of DSM* | *Process migration and case studies* | *Security in Distributed OS: Introduction* |
| S10 | SLO-1 | *Communication in Distributed System* | *System model* | *Advantages & challenges of DSM* | *Naming: Overview, Features* | *Importance of security* |
| | SLO-2 | *Computer Network and Layered Protocols* | *Processor allocation* | *Design and implementation issues of DSM* | *Identifiers, Addresses, Name Resolution* | *Types of External attacks* |
| S11-14 | SLO-1 | *Laboratory 2: Program to implement Remote procedure call* | *Laboratory 5: Implement process strategies: creation of child, zombie, orphan process* | *Laboratory 8: Program to Increment a Counter in Shared Memory* | *Laboratory 11: Access control policies* | *Laboratory 14: Program to implement Chat Server* |
| | SLO-2 | | | | | |
| S15 | SLO-1 | *Message passing and related issues* | *Scheduling in distributed systems* | *Advantages & challenges of DSM* | *System oriented names* | *Basic elements of Information System security and policy* |
| | SLO-2 | *ATM Networks* | *Load balancing and sharing approach* | *Memory coherence* | *Object locating mechanisms* | *Trust Management* |
| S16 | SLO-1 | *Client Server model & its implementation* | *Fault tolerance* | *Granularity, structure of shared memory space* | *Issues in designing human oriented names* | *Access Control Models* |
| | SLO-2 | | | | | |
| S17 | SLO-1 | *Remote Method Invocation* | *Real time distributed systems,* | *Replacement strategy* | *Name caches, Naming and security* | *Cryptography* |
| | SLO-2 | *Case Studies: SUN RPC, DEC RPC* | *Process migration and related issues* | *Thrashing* | *DNS* | *Case Study: Sun Network File System, Andrew Network file system* |
| S18-21 | SLO-1 | *Laboratory 3: Basic calculator program using RMI* | *Laboratory 6: Program to implement token/non token based algorithm for Mutual Exclusion* | *Laboratory 9: Allocation methods, Directory Management* | *Laboratory 12: Study of Object Loading Mechanisms* | *Laboratory 15: Security in Operating Systems, System Access Threats, Intruders* |
| | SLO-2 | | | | | |

| | | |
|---|---|---|
| **Learning Resources** | 1. Pradeep K. Sinha, "Distributed Operating System Concepts and Design ", PHI, New Delhi, 2007.<br>2. Andrew S. Tanenbaum, "Distributed Operating Systems "Pearson Education, 2011. | 3. "Distributed Systems: Concepts and Design", George Coulouris, Jean Dollimore, Tim Kindberg, Pearson, 5th Edition,2012.<br>4. Mukesh Singhal, Niranjan G.Shivaratri, "Advance concepts in operating systems: Distributed, Database and multiprocessor operating systems", TMH, 2001.<br>5. Andrew S.Tanenbaum, "Modern operating system", PHI, 2003. |

**Learning Assessment**

| Bloom's Level of Thinking | | Continous Learning Assessment(50% Weightage) | | | | | | | | Final Examination (50% weightage) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4# (10%) | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100% | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc

| Course Designers | | |
|---|---|---|
| **Experts from Industry** | **Experts from Higher Technical Institutions** | **Internal Experts** |
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr.S.Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | Dr.S.P.Angelin Claret<br>Mr.Ramesh |

| Course Code | PCS21C06J | Course Name | BIG DATA ANALYTICS | Course Category | C | Professional Core Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 | 0 | 4 | 5 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: |
|---|---|
| CLR-1 : | *Understand the evolution of computer networks using the layered network architecture* |
| CLR-2 : | *Understand the addressing concepts and learn networks devices* |
| CLR-3 : | *Design computer networks using subnetting and routing concepts* |
| CLR-4 : | *Understand the error types, framing, flow control* |
| CLR-5 : | *Understand the various Medium Access Control techniques and also the characteristics of physical layer functionalities* |
| CLR-6 : | *Know the algorithms behind the protocols that helps data transfer* |

| Course Learning Outcomes (CLO): | At the end of this course, learners will be able to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Fundamental Knowledge | Application of Concepts | Link with Related Disciplines | Procedural Knowledge | Skills in Specialization | Ability to Utilize Knowledge | Skills in Modeling | Analyze, Interpret Data | Investigative Skills | Problem Solving Skills | Communication Skills | Analytical Skills | PSO 1 | PSO 2 | PSO 3 |
| CLO-1 : | *Acquire the basics of computer network and its architecture* | 3 | 80 | 70 | L | H | - | H | L | - | - | - | | | | | | - | - |
| CLO-2 : | *Acquire the knowledge of various networks devices and addressing methods* | 3 | 85 | 75 | M | H | L | M | L | - | - | - | | | | | | - | - |
| CLO-3 : | *Design the network routing methods* | 3 | 75 | 70 | M | H | M | H | L | - | - | - | | | | | | - | - |
| CLO-4 : | *Find the error type that may happen during data transportation* | 3 | 85 | 80 | M | H | M | H | L | - | - | - | | | | | | - | - |
| CLO-5 : | *Understand the physical layer functions and components* | 3 | 85 | 75 | H | H | M | H | L | - | - | - | | | | | | - | - |
| CLO-6 : | *Speak on the topology chosen for a architecting a network that an organization demands* | 3 | 80 | 70 | L | H | - | H | L | - | - | - | | | | | | - | - |

| Duration (hour) | | 21 | 21 | 21 | 21 | 21 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Introduction to BigData platform* | *Null and Alternative Hypotheses.* | *History of Hadoop* | *Setting up a Hadoop Cluster* | *Applications on Big Data* |
| | SLO-2 | | *Type-I and Type-II ErrorCriticalRegion and Level of Significance* | | | |
| S-2 | SLO-1 | *Challenges of Conventional Systems* | *One tailed and two tailed tests* | *The Hadoop Distributed File System* | *Cluster specification -* | *Data processing operators in Pig* |
| | SLO-2 | | | | | |
| S-3 | SLO-1 | *Intelligent data Analysis* | *Critical values of significant values* | *Components of Hadoop* | *Cluster Setup and Installation* | *Hive QL,Tables* |
| | SLO-2 | | | | | |
| S4-7 | SLO-1 | *Laboratory 1 : Practice elementary mathematical operations and control statements* | *Laboratory 4 : Creating Various types of plots /charts from various data source* | *Laboratory 7 : Implementation of Linear regression with multiple regression* | *Laboratory 10: Implementation of classifier problem* | *Laboratory 13 : Implementation of decision tree* |
| | SLO-2 | | | | | |
| S-8 | SLO-1 | *Nature of data* | *Tests of Significance for Large Samples* | *Analyzing the Data with Hadoop* | *Hadoop Configuration* | *Structure of Hbase* |
| | SLO-2 | | | *Scaling Out- Hadoop Streaming* | | |
| S-9 | SLO-1 | *Analytic process and tools* | *- Test of Significance for Single Proportion* | *Java interfaces to HDFS* | *Security in Hadoop* | *Hbase QL* |
| | SLO-2 | | *Test of Significance for Difference of Proportions* | *Java interfaces to HDFS* | | |
| S-10 | SLO-1 | *Analysis Vs Reporting* | *Test of Significance for Single Mean* | *How Map Reduce Works* | *Administering Hadoop* | *Comparing base with Relational* |

| Duration (hour) | | 21 | 21 | 21 | 21 | 21 |
|---|---|---|---|---|---|---|
| | SLO-2 | *Modern Data analytic tools* | *Test of Significance for Difference of Means. Chi-Square Distribution* | *Anatomy of a Map Reduce Job run* | | *Database* |
| S11-14 | SLO-1 | *Laboratory 2 : Operations on Matrices and Vectors* | *Laboratory 5 : Create subplots and color plots* | *Laboratory 8 : Implementation of Data preprocessing methods , Correlation matrix* | *Laboratory 11 : Implementation of K-Mean Clustering* | *Example 14 : Implementation of Random Forest* |
| | SLO-2 | | | | | |
| S-15 | SLO-1 | *Parameter and Statistic* | *To test the goodness of fit.- To test the independence of Attributes. Student's" t" - Distribution* | *Failures* | *Administering Hadoop -HDFS* | *Structure of Zoo Keeper* |
| | SLO-2 | | | *Job scheduling shuffle and sort* | | |
| S-16 | SLO-1 | *Sampling Distribution-* | *Definition- Applications of Student's "t" – Distribution- To test for Single Mean- To test for Difference of Means* | *Task Execution –Map read and Map write anatomy* | *Monitoring* | *The Zoo keeper services* |
| | SLO-2 | | | | | |
| S-17 | SLO-1 | *Meaning-Standard Error and its uses. Tests of Significance* | *F-Distribution- Definition- To Test for Equality of Two Population variances. Meaning of Resampling and its uses* | *Map reduce features* | *Maintenance* | *Case study* |
| | SLO-2 | | *Prediction Error and its uses.* | | | |
| S18-21 | SLO-1 | *Laboratory 3 : Vectorized operation on simple matrix operations* | *Laboratory 6 : Implement Linear regression problem* | *Laboratory 9 : Implementation of spam and non-spam classification problem.* | *Laboratory 12 : Implementation of K-Mean Clustering* | *Laboratory 15 : Implementation of CART* |
| | SLO-2 | | | | | |

| **Learning Resources** | |
|---|---|
| | 1. Michael Berthold, David J. Hand, (2007), "Intelligent Data Analysis", Springer.<br>2. RSN Pillai, Bagavathi, "Statistics Theory and Practice", S.Chand<br>3. Tom White (2012), " Hadoop:The Definitive Guide" Third Edition, O'reilly Media<br>4. AnandRajaraman and Jeffrey David Ullman, (2012) "Mining of Massive Datasets", Cambridge University Press.<br>5. Viktor Mayer,Schonberger,KennethCukier , "BIg Data : A Revolution That Will Transform How We Live, Work and Think". |

| **Learning Assessment** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Bloom's Level of Thinking** | | **Continuous Learning Assessment (50% weightage)** | | | | | | | | **Final Examination (50% weightage)** | |
| | | **CLA – 1 (10%)** | | **CLA – 2 (10%)** | | **CLA – 3 (20%)** | | **CLA – 4 (10%)#** | | | |
| | | **Theory** | **Practice** | **Theory** | **Practice** | **Theory** | **Practice** | **Theory** | **Practice** | **Theory** | **Practice** |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100% | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

| **Course Designers** | | |
|---|---|---|
| **Experts from Industry** | **Experts from Higher Technical Institutions** | **Internal Experts** |
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr.S.Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | Mrs. P. Yogalakshmi<br>Dr. P.Muthulakshmi |

| Course Code | PCS21E04J | Course Name | ADVANCED MACHINE LEARNING | Course Category | D | Discipline Elective Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 | 0 | 2 | 4 |

| Pre-requisite Courses | Machine Learning | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: |
|---|---|
| CLR-1 : | *To gain knowledge in the areas of Machine Learning.* |
| CLR-2 : | *To understand algorithms for analyzing data* |
| CLR-3 : | *To learn advanced algorithms for analytics* |
| CLR-4 : | *To discover patterns in the user data* |
| CLR-5 : | *To make predictions and intricate patterns* |

| Course Learning Outcomes (CLO): | At the end of this course, learners will be able to: | Learning | | |
|---|---|---|---|---|
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) |
| CLO-1 : | *Understand Machine Learning and concept learning* | 3 | 80 | 70 |
| CLO-2 : | *Develop a Learning System* | 3 | 85 | 75 |
| CLO-3 : | *Understand and Apply Machine Learning inreal time problem* | 3 | 75 | 70 |
| CLO-4 : | *Learn the basics of data collection* | 3 | 85 | 80 |
| CLO-5 : | *Knowledge about analysis and inference* | 3 | 85 | 75 |

| Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| Fundamental Knowledge | Application of Concepts | Link with Related Disciplines | Procedural Knowledge | Skills in Specialization | Ability to Utilize Knowledge | Skills in Modeling | Analyze, Interpret Data | Investigative Skills | Problem Solving Skills | Communication Skills | Analytical Skills | PSO 1 | PSO 2 | PSO 3 |
| L | H | - | H | L | - | - | - | | | | | - | - | - |
| M | H | L | M | L | - | - | - | | | | | - | - | - |
| M | H | M | H | L | - | - | - | | | | | - | - | - |
| M | H | M | H | L | - | - | - | | | | | - | - | - |
| H | H | M | H | L | - | - | - | | | | | - | - | - |

| Duration (Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Introduction to Machine Learning* | *Support vector machine* | *Euclidean Distance* | *Role of Distance Measures* | *Implementing any one classification algorithm* |
| | SLO-2 | *Types of learning* | *K-Nearest Neighbors* | *Hamming Distance* | *Information Retrieval and Extraction* | *Model Selection* |
| S-2 | SLO-1 | *Supervised learning* | *Classification accuracy* | *Manhattan Distance* | *Categorization* | *Tree Models* |
| | SLO-2 | *Unsupervised learning* | *Introduction to Decision trees* | *Minkowski Distance* | *Clustering* | *Boosting* |
| S-3 | SLO-1 | *Issues in Machine Learning* | *Splitting approaches in decision tree* | *Similarity Functions* | *Border increment text mining algorithm* | *Tensorflow* |
| | SLO-2 | *Perspectives* | *Gini Impurity* | *Error measures* | *compare the various distance calculation methods* | *Keras* |
| S4-5 | SLO-1 | *Laboratory 1: Concept Learning task* | *Laboratory 4:Extract the data from database* | *Laboratory 7:Implement decision tree algorithm* | *Laboratory10: compare the various distance calculation methods by implementing any one classification algorithm* | *Laboratory13: Implement Text Mining* |
| | SLO-2 | | | | | |
| S-6 | SLO-1 | *Concept Learning as a search* | *Information Gain* | *K-Means algorithm* | *Implement K-Means Algorithm* | *Advanced Regression* |
| | SLO-2 | *Issues regarding classification* | *Chi-square* | *Fuzzy C Means algorithm* | *Hierarchial Clustering* | *Timeseries Processing* |
| S-7 | SLO-1 | *Issues regarding Prediction* | *Classification by decision tree induction* | *Expectation approach* | *Extended decision trees* | *Transformer Networks* |
| | SLO-2 | *Various types of classifications* | *Tree pruning methods* | *Maximization approach* | *Linear Regression* | *Semantic Segmentation* |
| S-8 | SLO-1 | *Bayesian Classification* | *Cost complexity pruning* | *Probabilistic clustering algorithms* | *Logistic Regression* | *Generative Models* |

| Duration (Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| | SLO-2 | *Classification by back propagation* | *Implementation of learning models for real time problem* | *Introduction to text analytics* | *Naive Bayes* | *Model Interpretation* |
| S9-10 | SLO-1 | *Laboratory2: Design a Learning System* | *Laboratory 5: Implement Bayesian classification* | *Laboratory 8: Learn Waikato Environment for Knowledge Analysis tool to pre-process the data* | *Laboratory 11: Implement K-Means Algorithm* | *Laboratory 14: Implement various operations of text analytics* |
| | SLO-2 | | | | | |
| S-11 | SLO-1 | *Reinforcement Learning* | *Implement k-nearest neighbours classification* | *Chi square pruning* | *Implement various operations of text analytics* | *Convolutional Neural Networks* |
| | SLO-2 | *Classification based on concepts from association rule mining* | *Issues in decision trees* | *AI in text mining* | *Implement NLP* | *Benefits of CNN* |
| S-12 | SLO-1 | *Goals and applications of machine learning* | *Extended Decision Trees* | *Pre-processing techniques* | *Explore NLP* | *Recurrent Neural Networks* |
| | SLO-2 | *Logistic Regression* | *Fuzzy decision trees* | *Feature selection using dimensionality reduction* | *Over fitting* | *Overview of RNN* |
| S-13 | SLO-1 | *Overview of classification* | *Hierarchical clustering algorithm* | *Summarization* | *validation dataset* | *Benefits of RNN* |
| | SLO-2 | *setup* | *Mixture of Gaussian algorithm* | *Foundations of NLP* | *training, test* | *Drawbacks of RNN* |
| S 14-15 | SLO-1 | *Laboratory 3: Implementation of learning models for real time problem* | *Laboratory 6: Implement k-nearest neighbours classification* | *Laboratory 9: Implement weka tool for Hospital management* | *Laboratory 12:Implement any one clustering algorithm* | *Laboratory 15:Implement NLP* |
| | SLO-2 | | | | | |

| **Learning Resources** | |
|---|---|
| 1. EthemAlpaydin, Introduction to Machine Learning, Third edition, The MIT Press Cambridge.<br>2. Tom M Mitchell, Machine Learning, McGraw Hill Education<br>3. Jiawei Han and Micheline Kamber, ―Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, 3rd ed, 2010. | 4. LiorRokach and OdedMaimon, ―Data Mining and Knowledge Discovery Handbook, Springer, 2nd edition, 2010.<br>5. Ronen Feldman and James Sanger, ―The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Datall, Cambridge University Press, 2006. |

**Learning Assessment**

| Bloom's Level of Thinking | | Continous Learning Assessment(50% Weightage) | | | | | | | | Final Examination (50% weightage) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4# (10%) | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100% | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc

| **Course Designers** | | |
|---|---|---|
| **Experts from Industry** | **Experts from Higher Technical Institutions** | **Internal Experts** |
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr. S. Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | Dr. Arul Leena Rose<br>Dr. S. P. Angelin Claret |

| Course Code | PCS21E05J | Course Name | INTERNET OF THINGS | Course Category | D | Discipline Elective Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 | 0 | 2 | 4 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: |
|---|---|
| CLR-1 : | *Demonstrate the design, communication model and enabling technologies for IoT.* |
| CLR-2 : | *Explore the system management and domain for various applications of IoT* |
| CLR-3 : | *Categorize the various protocols that are used for developing IoT applications.* |
| CLR-4 : | *Deploy an IoT application and connect to the cloud.* |
| CLR-5 : | *Develop IoT application for real time scenario* |
| CLR-6 : | *Implementation of IoT application for real world problems* |

| Course Learning Outcomes (CLO): | At the end of this course, learners will be able to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Fundamental Knowledge | Application of Concepts | Link with Related Disciplines | Procedural Knowledge | Skills in Specialization | Ability to Utilize Knowledge | Skills in Modeling | Analyze, Interpret Data | Investigative Skills | Problem Solving Skills | Communication Skills | Analytical Skills | PSO 1 | PSO 2 | PSO 3 |
| CLO-1 : | *Apply the knowledge/understanding of mathematics, science, to the solution of complex problems applicable to the discipline* | 3 | 80 | 70 | L | H | - | H | L | - | - | - | | | | | - | - | - |
| CLO-2 : | *Design, implement, and evaluate a computer-based system, process, component, or program to meet desired solutions that meet the specified needs with suitable concern for the public health and safety, and the cultural, societal, and environmental considerations.* | 3 | 85 | 75 | M | H | L | M | L | - | - | - | | | | | - | - | - |
| CLO-3 : | *Create, select, and apply applicable techniques, resources, and modern engineering and IT tools to complex engineering activities with an understanding of the limitations.* | 3 | 75 | 70 | M | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-4 : | *Function successfully as an individual, and as a member or leader in assorted teams, and in multidisciplinary settings.* | 3 | 85 | 80 | M | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-5 : | *Prove knowledge and understanding of the engineering and management principles and apply the same to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.* | *3* | 85 | 75 | H | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-6 : | *Apprehend the importance of technology with the current scenario* | *3* | 80 | 70 | L | H | - | H | L | - | - | - | | | | | - | - | - |

| Duration (Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Introduction* | *IoT Levels and Deployment Templates* | *IoT System Management* | *MQTT, Difference between MQTT and HTTP* | *Process, Domain level specifications* |
| | SLO-2 | *Definition& Characteristics of IoT* | *level 0 , level 1, level 2* | *Advantages of IoT system management* | *CoAP, Types of CoAP* | *Information, service, IoT level specifications* |
| S-2 | SLO-1 | *Physical design of IoT, Things in IoT* | *Level 3, level 4, level 5* | *Disadvantages of IoT system management* | *Request and Response methods, Pros and Cons of CoAP* | *Functional view specifications, operational view specifications* |
| | SLO-2 | *IoT protocols* | *IOT Applications* | *Need of IoT system management* | *AMQP, Semantic, JSON-LD* | *Device & component Integration, Application development* |
| S-3 | SLO-1 | *Logical Design of IoT* | *Home Automation* | *Simple Network Management Protocol* | *Sensor network* | *IoT System for Weather Monitoring* |

| Duration (Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| | SLO-2 | *And its application* | *IOT enabled devices* | *Analysis of network management* | *Sensor network devices* | *real-time weather monitoring* |
| S4-5 | SLO-1 | *Laboratory 1: Define and Explain Eclipse IoT Project* | *Laboratory 4:Demonstrate a smart object API gateway service reference implementation in IoT toolkit* | *Laboratory 7: Explain the application framework and embedded software agents for IoT toolkit.* | *Laboratory 10: Give overview of Zetta.* | *Laboratory 13: Smart Irrigation System* |
| | SLO-2 | | | | | |
| S-6 | SLO-1 | *IoT Functional Blocks* | *Discuss Home automation problems* | *Introduction about IOT protocols* | *Man to Machine communications* | *Purpose* |
| | SLO-2 | *IoT Blocks* | *Discuss Real-time problems* | *Brief about IOT protocols* | *M2M functionalities* | *Requirements* |
| S-7 | SLO-1 | *IoT Communication Model* | *Discuss cities problem* | *Architecture of 6LowPAN* | *Wireless networks* | *Process* |
| | SLO-2 | *Interopearability in IoT* | *Discuss Framework problems* | *Embedded Systems* | *Comparisons of wired and wireless networks* | *Domain level specifications* |
| S8 | SLO-1 | *IoT Communication APIs* | *Discuss Industry problem* | *Network operator* | *Interoperability in IoT* | *Information, service, IOT level specifications* |
| | SLO-2 | *Sensors* | *Discuss mapping proxy* | *Architecture of IPv6* | *Introduction to Arduino* | *Functional view specifications,* |
| S9-10 | SLO-1 | *Laboratory 2: List and summarize few Eclipse IoT Projects.* | *Laboratory 5: Write and explain working of an HTTP- to-CoAP semantic mapping proxy in IoT toolkit.* | *Laboratory 8: Explain working of Raspberry Pi.* | *Laboratory 11: Home Automation – Level 0* | *Laboratory 14: Weather Reporting Systems* |
| | SLO-2 | | | | | |
| S-11 | SLO-1 | *Sensor types* | *Discuss Health & Lifestyle problem* | *Wi-Fi* | *Arduino programming* | *operational view specifications* |
| | SLO-2 | *Actuators and its types* | *Architecture of M2M* | *Bluetooth* | *Integration of sensors and actuators* | *Device & component Integration, Application development* |
| S-12 | SLO-1 | *Communication Protocols* | *Architecture of SDN* | *Physical Web* | *IoT Platforms* | *Introduction to Cloud Storage Models* |
| | SLO-2 | | | *mDNS* | *Design Methodology* | |
| S-13 | SLO-1 | *Embedded Systems* | *NFV for IoT* | *DNS-SD* | *Purpose* | *Amazon Web Services for IoT* |
| | SLO-2 | *Applications of embedded systems* | *Architecture of NFV* | *Data Protocols* | *Requirements* | *Discuss real-time example* |
| S14-S15 | SLO-1 | *Laboratory 3: Sketch the architecture of IoT Toolkit* | *Laboratory 6: Describe gateway as a service deployment in IoT toolkit* | *Laboratory 9: Connect Raspberry Pi with your existing system components* | *Laboratory 12: Home Automation – Level 4* | *Laboratory 15: Air Pollution Monitoring System* |
| | SLO-2 | | | | | |

| | | |
|---|---|---|
| **Learning Resources** | 1. ArshdeepBahga and Vijay Madisetti, (2015), "Internet of Things - A Hands-on Approach", Universities Press<br>2. Dieter Uckelmann et.al, (2011), "Architecting the Internet of Things", Springer<br>3. CunoPfister, (2011), "Getting Started with the Internet of Things", O'Reilly, 2011. | 4. Adrian McEwen, Hakim Cassimally, (2014), "Designing the Internet of Things", Wiley<br>5. HonboZhou, (2012), "The Internet of Things in the Cloud: A Middleware Perspective ", CRC Press<br>6. Olivier Hersent, David Boswarthick, Omar Elloumi, (2012), "The Internet of Things – Key applications and Protocols", Wiley |

**Learning Assessment**

| Bloom's Level of Thinking | | Continous Learning Assessment(50% Weightage) | | | | | | | | Final Examination (50% weightage) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4# (10%) | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100% | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

| **Course Designers** | | |
|---|---|---|
| **Experts from Industry** | **Experts from Higher Technical Institutions** | **Internal Experts** |
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr.S.Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | *Mrs.Aarthi.E*<br>*Mr. M. Ramesh* |

| Course Code | PCS21E06J | Course Name | BLOCK CHAIN TECHNOLOGIES | Course Category | D | Discipline Elective Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 | 0 | 2 | 4 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: | Learning | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) |
| CLR-1 : | *To understand the design principles of Bitcoin and Ethereum.* | | | |
| CLR-2 : | *To learn Nakamoto consensus* | | | |
| CLR-3 : | *Interact with a blockchain system by sending and reading transactions* | | | |
| CLR-4 : | *To design, build, and deploy a distributed application* | | | |
| CLR-5 : | *To evaluate security, privacy, and efficiency of a given blockchain system.* | | | |

| Course Learning Outcomes (CLO): | At the end of this course, learners will be able to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Fundamental Knowledge | Application of Concepts | Link with Related Disciplines | Procedural Knowledge | Skills in Specialization | Ability to Utilize Knowledge | Skills in Modeling | Analyze, Interpret Data | Investigative Skills | Problem Solving Skills | Communication Skills | Analytical Skills | PSO 1 | PSO 2 | PSO 3 |
| CLO-1 : | *Understand how blockchain systems (mainly Bitcoin and Ethereum) work* | 3 | 80 | 70 | L | H | - | H | L | - | - | - | | | | | | - | - |
| CLO-2 : | *To securely interact with blockchain nodes* | 3 | 85 | 75 | M | H | L | M | L | - | - | - | | | | | | - | - |
| CLO-3 : | *To Broadcast the transactions* | 3 | 75 | 70 | M | H | M | H | L | - | - | - | | | | | | - | - |
| CLO-4 : | *Design, build, and deploy smart contracts and distributed applications* | 3 | 85 | 80 | M | H | M | H | L | - | - | - | | | | | | - | - |
| CLO-5 : | *Integrate ideas from blockchain technology into their own projects* | 3 | 85 | 75 | H | H | M | H | L | - | - | - | | | | | | - | - |

| Duration (Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Blockchain Introduction* | *Database Vs. Blockchain Architecture* | *The Structure of Blockchains* | *Introduction to Cryptocurrency* | *Ethereum* |
| | SLO-2 | *Blockchain Architecture* | *Types of Blockchain Architecture* | *Blockchain Data Structure* | *Blockchain and Cryptocurrency* | *Overview of Ethereum* |
| S-2 | SLO-1 | *Blockchain Working* | *Public Blockchains* | *Transactions* | *Double Spending* | *Need for Ethereum* |
| | SLO-2 | *Blockchain Transactions* | *Private Blockchains* | *Blocks* | *Double Spending Example* | *Purpose of Ethereum* |
| S-3 | SLO-1 | *Need for Blockchain* | *Consortium Blockchains* | *Types of Blocks* | *Cryptography in Blockchain* | *Ethereum Vs Bitcoin* |
| | SLO-2 | *Applications of Blockchain* | *Hybrid Blockchains* | *Peer-to-Peer(P2P) Network* | *Types* | *Ethereum Blockchain* |
| S4-5 | SLO-1 | *Laboratory 1: Making the Blockchain Network nodes to run* | *Laboratory 4: Broadcasting the transactions* | *Laboratory 7: Implementation of an Interface with search functionality* | *Laboratory 10: Interact with a blockchain system by sending and reading transactions.* | *Laboratory 13: Smart Contract Construction in Solidity* |
| | SLO-2 | | | | | |
| S-6 | SLO-1 | *Blockchain Versions* | *Main components of Blockchain* | *Difference between Blockchain and Normal Database* | *Applications* | *Features of Ethereum* |
| | SLO-2 | *Blockchain Variants* | *Challenges in Blockchain* | *Consensus* | *Public Key Cryptography* | *Applications of Ethereum* |
| S-7 | SLO-1 | *Public* | *Centralized System* | *Consensus Algorithm* | *Use of Cryptography in Blockchain* | *Smart Contracts on Ethereum* |
| | SLO-2 | *Private* | *De-centralized System* | *Mining* | *Cryptographic hash functions* | *Ethereum Vs Ether* |
| S8 | SLO-1 | *Consortium* | *Key Elements of Blockchain* | *Proof of Work (PoW)* | *Types of cryptographic hash functions* | *Ether- Gas* |
| | SLO-2 | *Blockchain Use Cases* | *Distributed ledger technology* | *Proof of Work Mining* | *Bitcoin* | *How Ethereum is different from Bitcoin?* |
| S | SLO-1 | *Laboratory 2: Implementation of Broadcasting* | *Laboratory 5: Broadcasting multiple* | *Laboratory 8: Implementation of PoW* | *Laboratory 11: Mining puzzles* | *Laboratory 14: Interact with Solidity* |

| Duration (Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| 9-10 | SLO-2 | *Nodes* | *transactions* | *algorithm* | | *Contract in nodejs console* |
| S-11 | SLO-1 | *Important Real-life Use Cases of Blockchain* | *Immutable records* | *Proof of Stake (PoS)* | *Types of Bitcoin* | *Decentralized Applications* |
| | SLO-2 | *Bitcoin Cyrptocurrency* | *Smart contracts* | *How Proof of Stake (PoS) works?* | *Blockchain Hashing* | *Ethereum and Solidity* |
| S-12 | SLO-1 | *Most Popular Application of Blockchain* | *Components of Blockchain Architecture* | *Difference between PoW and PoS* | *Blockchain Hash Function* | *Testing in Solidity* |
| | SLO-2 | *Blockchain Vs. Shared Database* | *Key Characteristics of Blockchain Architecture* | *SHA256 Algorithm* | *Bitcoin Mining* | *Debugging in Solidity* |
| S-13 | SLO-1 | *Myths about Blockchain* | *Advantages of Blockchain* | *Working of SHA256 Algorithm* | *Purpose of Mining* | *Advantages of Ethereum* |
| | SLO-2 | *Limitations of Blockchain Technology* | *Blockchain Applications* | *Simplified Byzantine Fault Tolerance (SBFT)* | *Process of Mining* | *Disadvantages of Ethereum* |
| S 14-S15 | SLO-1 | *Laboratory 3: Synchronizing the nodes* | *Laboratory 6: Implementation of Mining* | *Laboratory 9: Implementation of POS algorithm* | *Laboratory 12: Design, build, and deploy a distributed application* | *Laboratory 15: Interact with solidity Contract in web browser* |
| | SLO-2 | | | | | |

| **Learning Resources** | 1. Tiana Laurence, Blockchain for Dummies, (2017), Wiley India Pvt.Ltd.<br>2. Tim Mathis, Blockchain: The Technology Behind Bitcoin And Other Cryptocurriences (EBook).<br>3. Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions (2018), Apress Media. |
|---|---|

**Learning Assessment**

| Bloom's Level of Thinking | | Continous Learning Assessment(50% Weightage) | | | | | | | | Final Examination (50% weightage) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4# (10%) | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100% | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc

**Course Designers**

| Experts from Industry | Experts from Higher Technical Institutions | Internal Experts |
|---|---|---|
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr.S.Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | Dr Kanchana |
| | | Dr. S.P. Angelin Claret |

| Course Code | PCS21S02J | Course Name | DATA MINING AND DATA WAREHOUSING | Course Category | S | Skill Enhancement Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 1 | 0 | 2 | 2 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | Nil | | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Engineering Knowledge | Problem Analysis | Design & Development | Analysis, Design, Research | Modern Tool Usage | Society & Culture | Environment & Sustainability | Ethics | Individual & Team Work | Communication | Project Mgt. & Finance | Life Long Learning | PSO - 1 | PSO - 2 | PSO – 3 |
| CLR-1 : | *Introduce the learners to the concept of data mining and warehousing* | | | | | | | | | | | | | | | | | | |
| CLR-2 : | *Learn the applications of Data Mining* | | | | | | | | | | | | | | | | | | |
| CLR-3 : | *Fundamentals of Classification and Clustering Techniques* | | | | | | | | | | | | | | | | | | |
| CLR-4 : | *Master data mining techniques in various applications like social, scientific and environmental context.* | | | | | | | | | | | | | | | | | | |
| CLR-5 : | *Develop skill in selecting the appropriate data mining algorithm for solving practical problems.* | | | | | | | | | | | | | | | | | | |
| CLR-6 : | *Understand the architecture of data warehouse, data marts, modeling of data in a data warehouse* | | | | | | | | | | | | | | | | | | |
| **Course Learning Outcomes (CLO):** | At the end of this course, learners will be able to: | | | | | | | | | | | | | | | | | | |
| CLO-1 : | *Understand the functionality and limitations of the various Data mining techniques* | 2 | 80 | 70 | H | H | H | H | H | | | | | | | | | | |
| CLO-2 : | *Develop application oriented data mining models* | 3 | 85 | 75 | H | H | H | H | H | | | | | | | | | | |
| CLO-3 : | *Have a clear understanding of the Learning methods* | 3 | 75 | 70 | H | H | H | H | H | | | | | | | | | | |
| CLO-4 : | *Describe different methodologies used in data warehousing.* | 3 | 85 | 80 | H | H | H | H | H | | | | | | | | | | |
| CLO-5 : | *Understand organization of data in a Data warehouse* | 3 | 85 | 75 | H | H | H | H | H | | | | | | | | | | |
| CLO-6 : | *Build a basic data warehouse* | 3 | 80 | 70 | H | H | H | H | H | | | | | | | | | | |

| Duration (Hour) | | 9 | 9 | 9 | 9 | 9 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Introduction to Data Mining, Data mining as the Evolution of information technology* | *Association Analysis-Market basket analysis, Methods of Frequent itemset mining, Apriori Algorithm* | *Classification Techniques-introduction, Decision tree induction Attribute selection Measures, Bayes' Classification method-Bayes theorem* | *CLUSTERING Analysis – Introduction, K- means method, k-mediods method* | *Introduction to Data Warehousing, Why have a separate data warehouse, Multi-tired architecture- Data warehouse models* |
| | SLO-2 | *Data and large datasets, Kinds of Pattern in data mining, Technology used in data mining* | *Frequent Itemesets, closed itemsets, Association rules, Generating Association Rules from frequent Itemset, Pattern Growth Approach* | *-Supervised Vs Unsupervised classifications, Tree pruning, Scalability and decision tree induction* | *Overview of clustering methods, Hierarchical clustering, Agglomerative clustering* | *Operational database systems versus Data warehouses, Extraction, Transformation, Loading- Meta data repository Architecture of DW* |
| S 2-3 | SLO-1 | *Laboratory 1: Explore machine learning tool "WEKA" Downloading and/or installation of WEKA data mining toolkit* | *Laboratory 4: Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets* | *Laboratory 7: - Demonstrate performing classification on data sets* | *Laboratory 10: Demonstrate performing clustering of data sets* | *Laboratory 13: Creation of a Data Warehouse. Kappa statistic.* |
| | SLO-2 | | | | | |
| S 4 | SLO-1 | *Database systems, Machine learning, Web search Engines, Data Mining Issues in Mining methodology* | *Vertical Data Format, Pattern Evaluation methods, Pattern mining* | *Naive Bayesian Classification, Rule Extraction, Rule Induction* | *Probablistic Hierarchical clustering , Density based method* | *Multi dimensional data model-Data cube, Role of concept hierarchies* |

| Duration (Hour) | | 9 | 9 | 9 | 9 | 9 |
|---|---|---|---|---|---|---|
| | SLO-2 | *Data warehouse – Introduction, Kinds of applications-Business Intelligence, DM versus Knowledge Discovery in Databases* | *Mining of closed and Max Patterns, Mining Multi level associations, Mining multidimensional associations* | *Rule Based Classification : IF-Then Rules for classification, Confusion Matrix* | *Chameleon method, DBSCAN, OPTICS* | *Schemas for multidimensional data models, OLAP, operations, Querying multidimensional databases* |
| S 5-6 | SLO-1 | *Laboratory 2: Perform data preprocessing tasks* | *Laboratory5: Explore various options available in Weka for preprocessing data* | *Laboratory8: Explore various options available in Weka for preprocessing data* | *Laboratory 11: Load each dataset into Weka and run 1d3, J48 classification algorithm. Study the classifier output. Compute entropy values.* | *Laboratory 14: create a query based on multidimentional databases* |
| | SLO-2 | | | | | |
| S 7 | SLO-1 | *User interaction, Efficiency and scalability,Diversity of data types* | *Mining quantitative association rules , Graph Mining-Frequent sub-graph mining* | *Precision , Classification by Back propagation* | *DENCLUE, Evaluation of clustering methods* | *Data warehouse design and uses, Data warehouse Implementations* |
| | SLO-2 | *Data pre-processing, Overview of Applications of Data Mining, Data Objects and Attributes types* | *Mining rare patterns and negative patterns, Constraints based pattern generation* | *Recall, Support vector machine* | *Grid based clustering methods, Measuring cluster qualilty* | *DW design process, OLAP Server Architectures* |
| S 8-9 | SLO-1 | *Laboratory 3: Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets* | *Laboratory6: Explore various options available in Weka for preprocessing data and apply unsupervised filters like Discretization, Resample filter, etc. on each dataset* | *Laboratory 9: Load each dataset into Weka and run Id3, J48 classification algorithm. Study the classifier output. Compute entropy values, Kappa statistic.* | *Laboratory 12: Load each dataset into Weka and run simple k-means clustering algorithm with different values of k (number of desired clusters). Study the clusters formed. Observe the sum of squared errors and centroids, and derive insights* | *Laboratory 15: Creation of a Data Warehouse.* |
| | SLO-2 | | | | | |

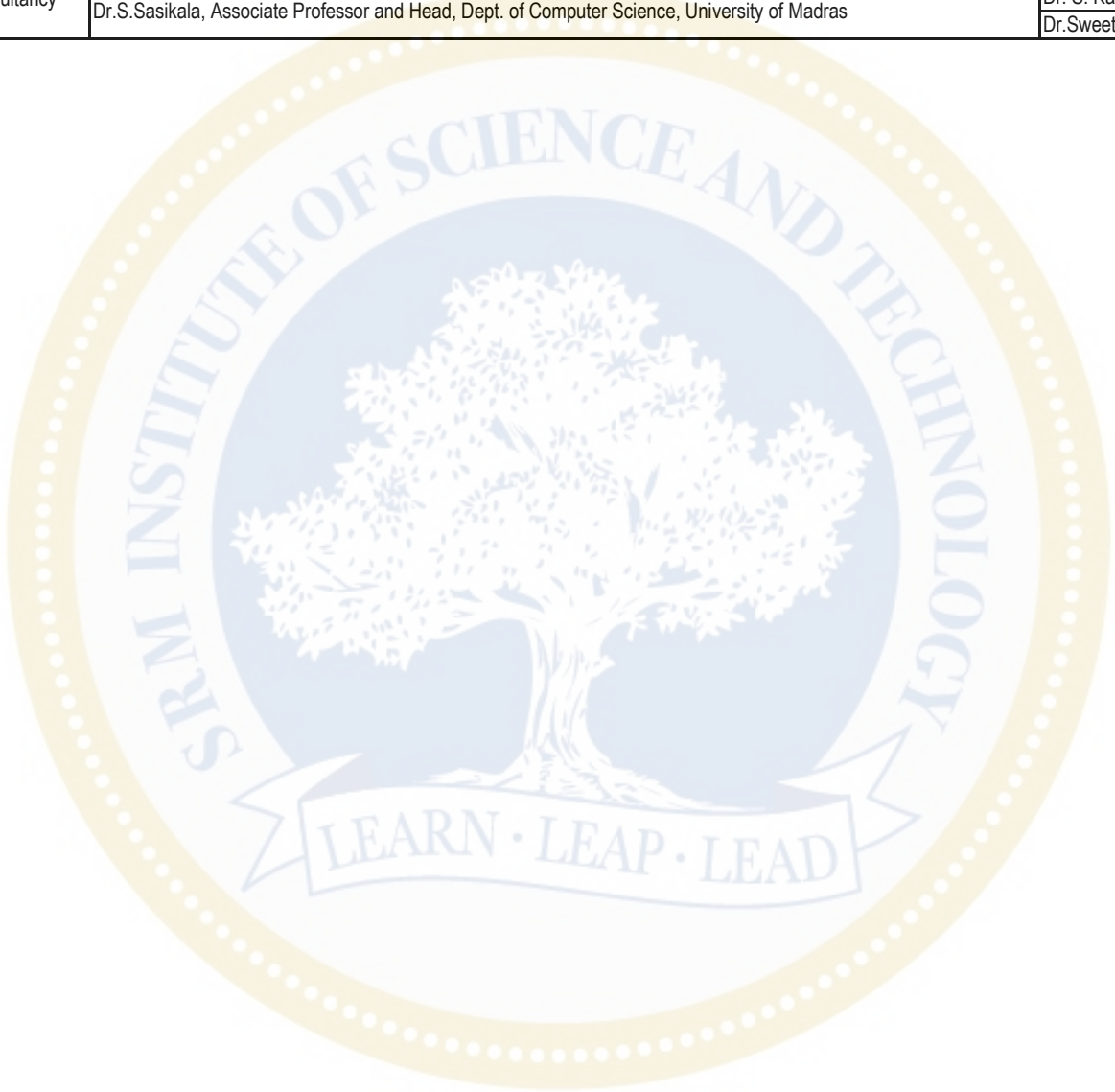
| **Learning Resources** | 1. Data mining and warehousing, S. Prabhu, N.Venatesan, New Age International, 2007<br>2. Data Mining, Concepts and Techniques, JiaweiHan, MichelineKambar, Jian Pie, 3rd edition, 2011. | 5. 3."Introduction to data mining" by Tan, Steinbach & Kumar (2006) |
|---|---|---|

| **Learning Assessment** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Bloom's Level of Thinking** | **Continuous Learning Assessment (100% weightage)** | | | | | | | |
| | | **CLA – 1 (20%)** | | **CLA – 2 (20%)** | | **CLA – 3 (30%)** | | **CLA – 4# (30%)** | |
| | | **Theory** | **Practice** | **Theory** | **Practice** | **Theory** | **Practice** | **Theory** | **Practice** |
| Level 1 | Remember | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% |
| | Understand | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | |
| Level 3 | Evaluate | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Create | | | | | | | | |
| | Total | 100% | | 100% | | 100% | | 100 % | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

| **Course Designers** | | |
|---|---|---|
| **Experts from Industry** | **Experts from Higher Technical Institutions** | **Internal Experts** |

| | | |
|---|---|---|
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr.S.Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | Dr. S. Kanchana<br>Dr.Sweety |



| Course Code | PCD21AE2T | Course Name | GENERAL APTITUDE FOR COMPETITIVE EXAMINATIONS | Course Category | A | Ability Enhancement Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 1 | 0 | 0 | 1 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Career Development Centre | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: | Learning | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) |
| CLR-1: | *Recapitulate fundamental mathematical concepts and skills* | | | |
| CLR-2: | *Provide context - based vocabulary enhancement* | | | |
| CLR-3: | *Sharpen logical reasoning through skilful conceptualization* | | | |
| CLR-4: | *Familiarize with basic grammatical and syntactical rules* | | | |
| CLR-5: | *Enable to solve problems and to crack competitive exams* | | | |
| CLR-6: | *Develop new strategies to enhance reading comprehension* | | | |

| Course Learning Outcomes (CLO): | At the end of this course, learners will be able to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Disciplinary Knowledge | Critical Thinking | Problem Solving | Analytical Reasoning | Research Skills | Team Work | Scientific Reasoning | Reflective Thinking | Self-Directed Learning | Multicultural Competence | ICT Skills | Life Long Learning | PSO - 1 | PSO - 2 | PSO - 3 |
| CLO-1: | *Build a strong base in the fundamental mathematical concepts* | 2 | 80 | 75 | H | H | H | H | H | H | H | H | H | H | M | H | H | H | H |
| CLO-2: | *Acquire strategies to build vocabulary* | 2 | 80 | 70 | H | H | H | H | H | H | H | H | H | H | M | H | H | H | H |
| CLO-3: | *Apply the learn conditions towards solving problems analytically* | 2 | 75 | 70 | H | H | H | H | H | H | H | H | M | H | M | H | H | H | H |
| CLO-4: | *Learn grammatical and syntactical rules* | 2 | 80 | 75 | H | H | H | H | H | H | H | H | H | H | M | H | H | H | H |
| CLO-5: | *Grasp the approaches and strategies to solve problems with speed and accuracy* | 2 | 80 | 70 | H | H | H | H | H | H | H | H | H | H | M | H | H | H | H |
| CLO-6: | *Improve reading comprehension strategies* | 2 | 80 | 75 | H | H | H | H | H | H | H | H | H | H | M | H | H | H | H |

| Duration (hour) | | 3 | 3 | 3 | 3 | 3 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Logical Reasoning I* | *Vocabulary from inference to meaning* | *Numbers - I* | *Error Identification - I* | *Data Sufficiency* |
| | SLO-2 | *Solving Problems* | *Vocabulary from inference to meaning* | *Numbers - I* | *Error Identification - I* | *Data sufficiency* |
| S-2 | SLO-1 | *Logical Reasoning - I* | *Cloze passage* | *Numbers - II* | *Error Identification - II* | *Data Interpretation* |
| | SLO-2 | *Solving Problems* | *Cloze passage* | *Numbers - II* | *Error Identification - II* | *Data Interpretation* |
| S-3 | SLO-1 | *Logical Reasoning - I* | *Sentence Completion* | *Numbers - III* | *Sentence Correction - I* | *Sentence Correction - II* |
| | SLO-2 | *Solving problems* | *Sentence Completion* | *Numbers - III* | *Sentence Correction - I* | *Sentence Correction - II* |

| Learning Resources | |
|---|---|
| | 1. Quantitative aptitude – r s agarwal |
| | 2. Quantitative aptitude – ARUN SARMA |
| | 3. ManhattanPrepGMAT Sentence Correction Guide–AviGutman |
| | 4. GRE Contextual.Vocabulary–Ken Springer |

| Learning Assessment | | | | | |
|---|---|---|---|---|---|
| Level | Bloom's Level of Thinking | Continuous Learning Assessment (100% weightage) | | | |
| | | CLA-1 (20%) | CLA-2 (20%) | CLA-3 (30%) | CLA-4 (30%) ## |

| | | Theory | Theory | Theory | Theory |
|---|---|---|---|---|---|
| Level 1 | Remember | 10% | 10% | 30% | 15% |
| | Understand | | | | |
| Level 2 | Apply | 50% | 50% | 40% | 50% |
| | Analyze | | | | |
| Level 3 | Evaluate | 40% | 40% | 30% | 35% |
| | Create | | | | |
| | Total | 100 % | 100 % | 100 % | 100 % |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

| **Course Designers** | | |
|---|---|---|
| Experts from Industry | Internal Experts | |
| 1. Mr Nishith Sinha, dueNorth India Academics LLP, Dehradun,nsinha.alexander@gmail.com | 1. Dr.P.Madhusoodhanan SRMIST | 3. Dr. A Clement, SRMIST |
| 2.Mr Ajay Zenner, Career Launcher, ajay.z@careerlauncher.com | 2. Dr.M.Snehalatha SRMIST | 4. Dr. J Jayapragash, SRMIST |

**#Can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,**

| **Course Designers** | |
|---|---|
| **Experts from Industry** | **Internal Experts** |
| 1. Ajay Zener, Director, Career Launcher | 1. Dr P Madhusoodhanan, HoD, CDC, E&T, SRMIST |
| | 2. Dr M Snehalatha, Assistant. Professor, CDC, E&T, SRMIST |

**SEMESTER-III**

| Course Code | PCS21C07J | Course Name | PYTHON PROGRAMMING | Course Category | C | Professional Core | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 4 | 0 | 2 | 5 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: | Learning | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) |
| CLR-1 : | *Describe the core syntax and semantics of Python programming language.* | | | |
| CLR-2 : | *Discover the need for working with the strings and functions.* | | | |
| CLR-3 : | *Illustrate the process of structuring the data using lists, dictionaries, tuples and sets.* | | | |
| CLR-4 : | *Indicate the use of regular expressions and built-in functions to navigate the file system.* | | | |
| CLR-5 : | *Infer the Object-oriented Programming concepts in Python.* | | | |
| CLR-6 : | *Understand Event Driven Programming* | | | |

| Course Learning Outcomes (CLO): | At the end of this course, learners will be able to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Fundamental Knowledge | Application of Concepts | Link with Related Disciplines | Procedural Knowledge | Skills in Specialization | Ability to Utilize Knowledge | Skills in Modeling | Analyze, Interpret Data | Investigative Skills | Problem Solving Skills | Communication Skills | Analytical Skills | PSO 1 | PSO 2 | PSO 3 |
| CLO-1 : | *Develop, document, and debug modular python programs to solve computational problems* | 3 | 80 | 70 | L | H | - | H | L | - | - | - | | | | | - | - | |
| CLO-2 : | *Select a suitable programming construct and data structure for a situation.* | 3 | 85 | 75 | M | H | L | M | L | - | - | - | | | | | - | - | - |
| CLO-3 : | *Use built-in strings, lists, sets, tuples and dictionary in applications.* | 3 | 75 | 70 | M | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-4 : | *Define classes and use them in applications* | 3 | 85 | 80 | M | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-5 : | *Use files for I/O operations.* | 3 | 85 | 75 | H | H | M | H | L | - | - | - | | | | | - | - | - |

| Duration (Hour) | | 18 | 18 | 18 | 18 | 18 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *An introduction to python programming* | *Arrays, Array methods* | *Equality: Object Identity, Structural Equivalence* | *Errors and exceptions, Exception handling in Python* | *Docstrings,* |
| | SLO-2 | *Structure of a Python program* | *Strings ,* | *Advanced list processing, List comprehension* | *Exception handling methods, Illustrate exception handling in Python* | *Method Definitions* |
| S-2 | SLO-1 | *understanding Python interpreter and Python Shell* | *String methods* | *Conversion of list to array, tuple, string* | *Introduction to modules,* | *The init Method,* |
| | SLO-2 | *Datatypes* | *mutable strings,* | *Conversion of array, string, tuple, dictionary to list* | *Important modules in Python* | *Instance Variables* |
| S3 | SLO-1 | *Example program using all data types* | *Immutable strings* | *Tuples* | *Creating modules* | *The str Method,* |
| | SLO-2 | *Example program using variables* | *String module,* | *tuple operation* | *accessing modules* | *Accessors* |
| S4 | SLO-1 | *String literals* | *Sum array of numbers* | *Tuple methods* | *Namespaces and its methods* | *Mutators* |
| | SLO-2 | *Escape Sequences* | *Funtions* | *Introduction to dictionary,* | *Locating modules, dir()* | *The Lifetime of Objects* |
| S5-6 | SLO-1 | *Laboratory 1: Write a Python code to display system information using pywhois* | *Laboratory 4:Make a simple calculator* | *Laboratory 7: Program to Transpose a Matrix Program for sorting using list Using a List to Find the Median of a Set of Numbers* | *Laboratory 10: Program using recursive function. Program to illustrate exception handling in Python* | *Laboratory 13: Program using classes and methods* |
| | SLO-2 | | | | | |

| Duration (Hour) | | 18 | 18 | 18 | 18 | 18 |
|---|---|---|---|---|---|---|
| S7 | SLO-1 | *String Concatenation* | *Function arguments* | *Operations* | *PYTHONPATH* | *Rules for Defining a Simple Class* |
| | SLO-2 | *Variables* | *Anonymous functions,* | *Methods,* | *Packages,* | *Rational Number* |
| S8 | SLO-1 | *assignment statement* | *Illustrate functions using python* | *Add, remove a key in dictionary* | *Creating packages* | *Arithmetic and Operator Overloading* |
| | SLO-2 | *Program Comments* | *Set declaration* | *Accessing values* | *accessing packages* | *Comparison Methods,* |
| S9 | SLO-1 | *Doc Strings* | *Set operation* | *Replacing Values,* | *Default (Keyword) Arguments,* | *Equality and the eq Method* |
| | SLO-2 | *Numerical Datatypes* | *Set methods* | *Traversing a dictionary* | *Functions as First-Class Data Objects* | *Input of Objects* |
| S10 | SLO-1 | *Character sets* | *Introduction to Lists* | *Introduction to file* | *Mapping* | *the try-except Statement* |
| | SLO-2 | *Arithmetic expressions* | *List literals* | *file creation* | *Filtering* | *Inheritance* |
| S 11-12 | SLO-1 | *Laboratory 2: The Magic 8 Ball is a toy used for fortune-telling or seeking advice.* | *Laboratory 5: Arrays and strings* | *Laboratory 8: Program on dictionary operations.Program on dictionary methods* | *Laboratory 11Writeapythonprogramtodefineamoduleandimport aspecificfunctioninthatmoduleto another program* | *Laboratory 14: Python Program for Operator overloading* |
| | SLO-2 | | | | | |
| S13 | SLO-1 | *Understanding error messages* | *Basic list operations* | *File operations* | *Reducing* | *Hierarchies* |
| | SLO-2 | *Logical operators* | *Replacing an Element in a List* | *Format operators* | *Using lambda to Create Anonymous Functions* | *Modeling* |
| S14 | SLO-1 | *Definite iteration : For loop* | *List methods with illustration,* | *Directory functions,* | *Standard Libraries in Python* | *Polymorphic Methods* |
| | SLO-2 | *Selection : if statement* | *Program to List Methods for Inserting Elements* | *File positions* | *Introduction to classes* | *Abstract Classes* |
| S15 | SLO-1 | *if else statement* | *Example program to Replace an Element in a List* | *Example program to access and manipulate files* | *Design with Classes* | *The Costs of object oriented programming* |
| | SLO-2 | *Example program using if and if else* | *Sorting and searching a list* | *Example program to read and write text and numbers* | *Objects* | *Benefits of Object-Oriented Programming* |
| S16 | SLO-1 | *Conditional iteration :while loop* | *Aliasing* | *Recursive functions* | *Classes* | *Event-Driven Programming,* |
| | SLO-2 | *Example program using while loop* | *mutator methods* | *Abstract functions* | *An example for class* | *Example for Event-Driven Programming* |
| S 17-18 | SLO-1 | *Laboratory 3: Check whether a number is prime or not, Python Program to Generate a Random Number* | *Laboratory 6: Program to illustrate set operations and its methods.Program to illustrate list opertions and its methods Program for list comprehension* | *Laboratory 9:Program to create and modify text file in Python Program for word count in text file.* | *Laboratory 12 : Programs to illustrate lambda functions with mapping, filtering ,reducing and substituting* | *Laboratory 15: Program using polymorphism, abstract classes* |
| | SLO-2 | | | | | |

| **Learning Resources** | Kenneth A. Lambert, (2011), "The Fundamentals of Python: First Programs", Cengage Learning |
|---|---|

**Learning Assessment**

| Bloom's Level of Thinking | | Continuous Learning Assessment (50% weightage) | | | | | | | | Final Examination (50% weightage) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4 (10%)# | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100% | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

| **Course Designers** | | |
|---|---|---|
| **Experts from Industry** | **Experts from Higher Technical Institutions** | **Internal Experts** |
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr.S.Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | 1. Mrs. E.Aarthi<br>2. Dr. P. Muthulakshmi |

| Course Code | PCS21C08J | Course Name | THEORY OF COMPUTATION | Course Category | C | Professional Core | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 4 | 0 | 2 | 5 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | Nil | | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: |
|---|---|
| CLR-1 : | *Understand the importance of theory of computation.* |
| CLR-2 : | *Understand the applications of TOC in various fields.* |
| CLR-3 : | *Learn the basics of pushdown automata.* |
| CLR-4 : | *Get Familiarity with the Turing machines.* |
| CLR-5 : | *Learn about the computable languages and functions.* |

| Course Learning Outcomes (CLO): | At the end of this course, learners will be able to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Fundamental Knowledge | Application of Concepts | Link with Related Disciplines | Procedural Knowledge | Skills in Specialization | Ability to Utilize Knowledge | Skills in Modeling | Analyze, Interpret Data | Investigative Skills | Problem Solving Skills | Communication Skills | Analytical Skills | PSO 1 | PSO 2 | PSO 3 |
| CLO-1 : | *Understand the role of a TOC in the industry.* | 3 | 80 | 70 | L | H | - | H | L | - | - | | | | | | | | |
| CLO-2 : | *Understand the applications of TOC in various fields.* | 3 | 85 | 75 | M | H | L | M | L | - | - | | | | | | - | - | - |
| CLO-3 : | *To understand and discuss selected advanced topics.* | 3 | 75 | 70 | M | H | M | H | L | - | - | | | | | | - | - | - |
| CLO-4 : | *To describe about the topics in TOC.* | 3 | 85 | 80 | M | H | M | H | L | - | - | | | | | | - | - | - |
| CLO-5 : | *Understand the concept of a construction of programming languages.* | 3 | 85 | 75 | H | H | M | H | L | - | - | | | | | | - | - | - |

| Duration (Hour) | | 18 | 18 | 18 | 18 | 18 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *An introduction to finite automata* | *Grammar introduction* | *Pushdown automata* | *Turing machines* | *Decidability and Recursively Enumerable* |
| | SLO-2 | *Basic mathematical notation and techniques* | *Types of grammar* | *Instantaneous descriptions* | *Definitions of Turing machines* | *The Definition of an Algorithm* |
| S-2 | SLO-1 | *Finite State systems* | *Context free grammar and languages* | *Deterministic pushdown automata* | *Representations of turing machine* | *Decidability* |
| | SLO-2 | *Basic Definitions* | *Moves* | *Examples* | *Representation of transition table* | *Decidable Languages* |
| S3 | SLO-1 | *Finite automation* | *Derivations and languages* | *Definitions* | *Representation of Transition diagram* | *Undecidable Languages* |
| | SLO-2 | *Transistion systems* | *Simplification of CFG* | *PDA* | *Language acceptability by Turing Machines* | *Problems* |
| S4 | SLO-1 | *Equivalence of NFA and DFA* | *Operations on Languages* | *Acceptance by pda* | *Design of turing machines* | *Halting Problems of Turing Machine* |
| | SLO-2 | *Example problems Has to be solved.* | *Examples* | *CFL-Introduction* | *Description of turing machines* | *Example* |
| S 5- 6 | SLO-1 | *Laboratory 1: Draw a deterministic and non-deterministic finite automate which accept 00 and 11 at the end of a string containing 0, 1 in it, e.g., 01010100 but not 000111010.* | *Laboratory 4:Construct a PDA for language L = {0n1m \| n >= 1, m >= 1, m > n+2}* | *Laboratory 7: Construct a PDA for language L = {ww' \| w={0, 1}*} where w' is the reverse of w.* | *Laboratory 10: Program to illustrate Chomsky Hierarchy in Theory of Computation* | *Laboratory 13: Design a deterministic finite automata (DFA) for accepting any language.* |
| | SLO-2 | | | | | |
| S 7 | SLO-1 | *Regular languages* | *Elimination of useless symbols* | *Pushdown automata* | *Techniques for TM Constructions* | *The p9ost Correspondence Problemn* |
| | SLO-2 | *Identities for regular expressions* | *Context-free Languages and Derivation Trees* | *context-free languages* | *Turing Machine with stationary Head* | *Problems to solve* |
| S 8 | SLO-1 | *Finite automation with €* | *Ambiguity* | *Parsing and pushdown Automata* | *Storage in the State* | *Computability* |
| | SLO-2 | *Transition system containing A- moves* | *Normal forms for context-free Grammars* | *Problems* | *Examples* | *Introduction and Basic Concepts* |

| Duration (Hour) | | 18 | 18 | 18 | 18 | 18 |
|---|---|---|---|---|---|---|
| S 9 | SLO-1 | *Equivalence of NDFA'S with and without € moves* | *Relationship between derivation and derivation trees* | *Top- down parsing* | *Multiple Track Turing Machine* | *Primitive Recursive Functions* |
| | SLO-2 | *Construction of finite automata equivalent* | *Explanation of derivative trees* | *Examples* | *Problems* | *Initial Functions* |
| S 10 | SLO-1 | *basic definitions of PDA* | *null productions* | *Top-down parsing using deterministic pda's* | *Multitape Turing machine* | *Primitive Recursive Functions over N* |
| | SLO-2 | *Acceptance of PDA* | *Elimination for null productions* | *Problems* | *Problems* | *Primitive Recursive Functions Over {a,b}* |
| S 11-12 | SLO-1 | *Laboratory 2: Draw a deterministic and non-deterministic finite automata which accept a string containing "the" anywhere in a string of {a-z}, e.g., "there" but not "those".* | *Laboratory 5: Construct a PDA for language L = {$0^n1^m2^m3^n$ \| n>=1, m>=1}* | *Laboratory 8: Draw a deterministic finite automata which recognize a string containing binary representation 0, 1 in the form of multiple 3, e.g., 1001 but not 1000.* | *Laboratory 11Write a program to define The halting problem.* | *Laboratory 14: Design a deterministic finite automata(DFA) for accepting the language L = {a^nb^m\| n+m= even}* |
| | SLO-2 | | | | | |
| S 13 | SLO-1 | *DFA & NDFA* | *Unit productions,* | *Bottom-up parsing* | *Non – Deterministic Turing Machine* | *Recursive Functions* |
| | SLO-2 | *Equivalence of finite automation and regular expressions* | *Elimination for unit productions* | *Problems* | *Problems* | *Partial Recursive Functions and Turing Machines* |
| S 14 | SLO-1 | *Minimization of DFA* | *Greiback normal form* | *LR(K) Grammars* | *The Model of Linear Bounded Automation* | *Computability* |
| | SLO-2 | *Minimization of DFA problems* | *Examples* | *Examples* | *Relation Between LBA and Context Sensitive Languages* | *A Turing Model for Computation* |
| S 15 | SLO-1 | *Pumping Lemma for regular sets* | *Chomsky normal form* | *Properties of LR(K) Grammars* | *TM and Type 0 Grammers* | *Turing – computable Functions* |
| | SLO-2 | *Problems based on pumping Lemma.* | *Problems* | *Explanation of each and every property* | *Construction of Grammer Corresponding to TM* | *Construction of the Turing Machine that can compute the Zero Function Z* |
| S 16 | SLO-1 | *regular expression* | *Problems related to CNF* | *Closure properties of languages* | *Linear bounded Automata and languages* | *Construction of the Turing Machine for Computing - The Successor function* |
| | SLO-2 | *Identities for Regular Expressions* | *Problems related to GNF* | *Examples* | *Problems* | *Construction of Turing Machine that can perform Recursion* |
| S 17-18 | SLO-1 | *Laboratory 3: Draw a deterministic and non-deterministic finite automata which accept a string containing "ing" at the end of a string in a string of {a-z}, e.g., "anything" but not "anywhere".* | *Laboratory 6: Construct a PDA for language L = {wcw' \| w={0, 1}*} where w' is the reverse of w.* | *Laboratory 9: Take an example to convert CFG to CNF. Consider the given grammar G1:*<br>*S → ASB*<br>*A → aAS\|a\|ε*<br>*B → SbS\|A\|bb* | *Laboratory 12 : Program to illustrate Chomsky Hierarchy in Theory of Computation* | *Laboratory 15: Draw a deterministic finite automata which recognize a string containing binary representation 0, 1 in the form of multiple 2, e.g., 1010 but not 01101.* |
| | SLO-2 | | | | | |

| | |
|---|---|
| **Learning Resources** | 1. Jeffery D Ullman, Motwani R John E Hopcroft Introduction to Automata theory language and computation second edition Pearson education 2008.<br>2. John C Matin " Introduction to language and the theory of Computation" third edition Tata Mc Graw Hill 2007. |

| Learning Assessment | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Bloom's Level of Thinking | | Continuous Learning Assessment (50% weightage) | | | | | | | | Final Examination (50% weightage) | |
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4 (10%)# | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100% | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

| Course Designers | | |
|---|---|---|
| Experts from Industry | Experts from Higher Technical Institutions | Internal Experts |
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr.S.Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | 1. Mrs. E.Aarthi<br>2. Dr. P. Muthulakshmi |

| Course Code | PCS21E07J | Course Name | STATISTICAL DATA ANALYTICS | Course Category | D | Discipline Elective Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 | 0 | 2 | 4 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to, |
|---|---|
| CLR-1 : | *Familiarize the concepts of design experts* |
| CLR-2 : | *Understand the various advantages of statistical analysis* |
| CLR-3 : | *Examine the basis of response methodologies* |
| CLR-4 : | *Understanding optimality and filtering error rate* |
| CLR-5 : | *Acquire the latest knowledge of split plot design and custom design* |

| Course Learning Outcomes (CLO): | At the end of this course, learners will be able to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Disciplinary Knowledge | Critical Thinking | Problem Solving | Analytical Reasoning | Research Skills | Team Work | Scientific Reasoning | Reflective Thinking | Self-Directed Learning | Multicultural Competence | Ethical Reasoning | Community Engagement | PSO 1 | PSO 2 | PSO 3 |
| CLO-1 : | *Identify the process of standard deviation, sampling distribution* | 3 | 80 | 70 | L | H | - | H | L | - | - | - | | | | | - | - | - |
| CLO-2 : | *Analyze and specify factorial design and basis of levels of design* | 3 | 85 | 75 | M | H | L | M | L | - | - | - | | | | | | | |
| CLO-3 : | *Design various responses, Behnken Design and optimization techniques.* | 3 | 75 | 70 | M | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-4 : | *Develop Plackett - Burman Design and Taguchi Outer Array Design* | 3 | 85 | 80 | M | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-5 : | *Perform by applying Plotting Split - plot Design and Simplex Lattic Design* | 3 | 85 | 75 | H | H | M | H | L | - | - | - | | | | | - | - | - |

| Duration(Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Introduction to Design Experiment* | *Introduction to Factorial Design* | *Introduction to response Surface Methodology* | *Introduction to Computer Generated Design's* | *Introduction to Split - Plot Design* |
| | SLO-2 | *Strategy of Experimentation* | *Factorial Design Basic Principles* | *The method of Steepest Ascent* | *Optimal Design's* | *Plotting Split - plot Design* |
| S-2 | SLO-1 | *Guidelines for Designing Experiments* | *The advantage of Statistical Analysis* | *Analysis of Second - Order Response Surface* | *Methods in Optimal Design* | *Whole Plot and Subplot Design's* |
| | SLO-2 | *Measures of Central Tendency* | *Power calculation of Factorial Design* | *Characterizing the Response Surface* | *An irregular Experimental Region* | *Other Variation on Split-plot Design* |
| S-3 | SLO-1 | *The Arithmetic Mean, Median and Mode* | *2 Level Method in Power Calculation* | *Ridge Surface* | *An Non-Standard Size Requirements* | *Split- plot Design for more than 2 factors* |
| | SLO-2 | *Introduction to Dispersion Measurement* | *Entering data and its Responses* | *Canonical Model in Ridge Surface* | *Design of Optimality Criteria* | *Custom Design* |
| S-4 to S-5 | SLO-1 | *Laboratory1: Experiment on Measures of Central Tendency* | *Laboratory4: Experiment on How to Enter the Response data.* | *Laboratory 7: Experimental Design for Fitting Ridge system* | *Laboratory10: Experiment on Optimal Design* | *Laboratory 13: Experiment on Split - Plot Method* |
| S-6 | SLO-1 | *Dispersion Variability* | *Estimating the Model Parameters* | *Multiple Response Approaches* | *Robust Parameter Design* | *Analysis of Custom Design* |
| | SLO-2 | *The Range* | *Analysis of Data* | *Formal Optimization* | *Taguchi Outer Array Design* | *Blank Spreadsheet Design* |
| S-7 | SLO-1 | *The Quartile* | *Process of Data* | *Formal Optimization Methods* | *Combined Array Design* | *Historical Data - The Introduction* |
| | SLO-2 | *The Variance and its Populations* | *Introduction to 2K Factorial Design* | *Formal Optimization in multiple Response* | *Method in Combined Array Design* | *A Peculiarity on Pasting Data* |
| S-8 | SLO-1 | *The Standard Deviation* | *The 2 - Level Design* | *Design for First - Order Model* | *Progration of errors* | *Selection of process order and Linear* |
| | SLO-2 | *Root mean Deviation* | *The 3 - Level Design* | *Design for Second - Order model* | *Filtering errors Rate* | *Combined Mixture Model* |

| Duration(Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| S-9 to S-10 | SLO-1 | *Laboratory 2: Experiment on Arithmetic Mean, Median and Mode.* | *Laboratory 5: Pre - Analysis of Effects via Data Sorts and Scatter Plots* | *Laboratory 8: Experiment on Central Composite Design(CCD)* | *Laboratory 11: Experiment on Taguchi Outer Array Design* | *Laboratory14: Optimal (Custom) Design in Split - Plot* |
| S-11 | SLO-1 | *Symmetry* | *Design Projection's for Normal Probability Plot* | *Central Composite Design* | *Evolutionary Operation* | *Process of Combined Mixture Model* |
| | SLO-2 | *Skewness* | *Data Transformation in Factorial Design* | *Sperical CCD* | *Plackett - Burman Design* | *Factorial With Mixed - level* |
| S-12 | SLO-1 | *Kurtosis* | *Duplicate Measurements on the Response data* | *The Box - Behnken Design* | *Method in PB Design* | *Simplex Lattic Design* |
| | SLO-2 | *Sampling Method* | *The composite design for 2 & 3 Factor's* | *Cuboidal Region of Interest for Box - Behnken Design* | *Design Matrix for Plackett - Burman* | *Simplex Lattic Design for Optimized Texture* |
| S-13 | SLO-1 | Sampling Distribution | Choosing Effects to Model | Other Designs in BB Design | Various steps in Screening Design | Introduction of Optimal Design |
| | SLO-2 | *The central Limit Theorem.* | *Pareto Chart and its Plotting* | *2 - Variable Response Surface* | *PB design for Medium Optimization* | *Optimal Design for Combined mixture process Design* |
| S-14 to S-15 | SLO-1 | *Laboratory3: Experiment on Symmetry, Skewness, Kurtosis. (SSK)* | *Laboratory6: Experiment on Regular 2 - Level Factorial Design* | *Laboratory 9: Experiment design for Box - Behnken Design* | *Laboratory12: Experimental Design for Box - Behnken Design.* | *Laboratory 15: Experiment on Simplex Lattin Design* |

| **Learning Resources** | 1. Richard Petersen - Linux : The Complete Reference ,Sixth edition .<br>2. Richard Stevens .W & Stephen Rago (2005), Advanced Programming in the UNIX Environment, 2nd Edition, Pearson Education, New Delhi (UNIT I,2 & 3). | 3. Richard Stevens .W (1999), UNIX Network Programming, Volume II, Prentice Hall, New Delhi (UNIT IV&5).<br>4. Stephen A.Rago (1993), Unix System V Network Programming, Addison Wesley, New York. |
|---|---|---|

**Learning Assessment**

| Bloom's Level of Thinking | | Continuous Learning Assessment (50% weightage) | | | | | | | | Final Examination (50% weightage) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4 (10%)# | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100% | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

**Course Designers**

| Experts from Industry | Experts from Higher Technical Institutions | Internal Experts |
|---|---|---|
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr.S.Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | Dr.S.P.Angelin Claret |
| | | Dr. Kalpana |

| Course Code | PCS21E08J | Course Name | CRYPTOGRAPHY AND NETWORK SECURITY | Course Category | D | Discipline Elective Courses | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 | 0 | 2 | 4 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: |
|---|---|
| CLR-1 : | *To become familiar with objective of research* |
| CLR-2 : | *To get exposed to resources for research* |
| CLR-3 : | *To learn art of writing and presentation* |
| CLR-4 : | *To study about the data collection* |
| CLR-5 : | *To learn about analysis and inference* |

| Course Learning Outcomes (CLO): | At the end of this course, learners will be able to: | Learning | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) |
| CLO-1 : | *Have a thorough understanding of steps involved in research preparation and planning* | 3 | 80 | 70 |
| CLO-2 : | *Perform literature review and case study* | 3 | 85 | 75 |
| CLO-3 : | *Learn the basics of academic writing and presentation* | 3 | 75 | 70 |
| CLO-4 : | *Learn the basics of data collection* | 3 | 85 | 80 |
| CLO-5 : | *Knowledge about analysis and inference* | 3 | 85 | 75 |

| Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| Fundamental Knowledge | Application of Concepts | Link with Related Disciplines | Procedural Knowledge | Skills in Specialization | Ability to Utilize Knowledge | Skills in Modeling | Analyze, Interpret Data | Investigative Skills | Problem Solving Skills | Communication Skills | Analytical Skills | PSO 1 | PSO 2 | PSO 3 |
| L | H | - | H | L | - | - | - | | | | | - | - | - |
| M | H | L | M | L | - | - | - | | | | | - | - | - |
| M | H | M | H | L | - | - | - | | | | | - | - | - |
| M | H | M | H | L | - | - | - | | | | | - | - | - |
| H | H | M | H | L | - | - | - | | | | | - | - | - |

| Duration (Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Overview on Symmetric Cipher Model* | *Overview on Block ciphers and the data encryption standard* | *Basic knowledge of Network security – Authentication Application* | *IP Security Overview* | *Overview on System Security* |
| | SLO-2 | *Conventional encryption model* | *Block Cipher Principles* | *Design of function F* | *Triple DES* | *AES cipher* |
| S-2 | SLO-1 | *Overview on Classical Encryption Techniques* | *The strength of DES* | *Kerberos* | *IP Security Architecture* | *Intruders* |
| | SLO-2 | *Substitution ciphers* | *Stream ciphers* | *S- box design* | *Cipher block chaining mode* | *AES algorithm* |
| S-3 | SLO-1 | *Brief on Symmetric Cipher Model* | *The Data Encryption Standard* | *Kerberos Authentication Service* | *Authentication Header* | *Intrusion Detection* |
| | SLO-2 | *Transposition techniques* | *Feistal cipher* | *Groups* | *Examples* | *AES encryprion* |
| S4-5 | SLO-1 | *Laboratory 1: Perform encryption, decryption using the following substitution techniques i)Ceaser cipher* | *Laboratory 4:vi) Vigenere Ciphers* | *Laboratory 7: Apply DES algorithm for practical applications* | *Laboratory 10: Implement the SIGNATURE SCHEME - Digital Signature Standard.* | *Laboratory 13: Apply AES algorithm for practical applications* |
| S-6 | SLO-1 | *Techniques involved in – Cryptography* | *Describe the procedure of DES Encryption* | *Overview on Electronic Mail Security* | *Encapsulating Security Payload* | *Password Management* |
| | SLO-2 | *Rotor machines* | *Diffusion* | *Rings* | *Examples* | *AES decryption* |
| S-7 | SLO-1 | *Principles involved in - Cryptanalysis* | *Describe the procedure of DES Decryption* | *Operational Description* | *Combining Security Associations* | *Discuss on Malicious Software* |

| Duration (Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| | SLO-2 | *Stegnography* | *Confusion* | *Fields* | *Digital Signature Standard* | *Transformation* |
| S-8 | SLO-1 | *Substitution Techniques- Caesar Cipher* | *Feistal description alg* | *Cryptographic Keys* | *Key Management* | *Viruses* |
| | SLO-2 | *Block Cipher* | *Examples* | *Examples* | *RSA Algortihm* | *Related Threats* |
| S9-10 | SLO-1 | *Laboratory 2: ii) playfair cipher* | *Laboratory 5: Perform encryption and decryption using following transposition techniques. Rail fence* | *Laboratory 8: example on DES* | *Laboratory 11: Apply RSA algorithm for practical applications.* | *Laboratory 14: example on AES* |
| S-11 | SLO-1 | *Monoalphabetic Ciphers* | *Differential and Linear Cryptanalysis* | *Public-Key Management* | *Overview on Web Security* | *Virus Counter measures* |
| | SLO-2 | *Playfair Cipher* | *Examples* | *Double DES* | *Meet in the middle attack* | *Examples* |
| S-12 | SLO-1 | *Hill Cipher* | *Block Cipher Design Principles* | *S/MIME (Secure/Multipurpose Internet Mail Extension)* | *Web Security Considerations* | *Overview on Firewall* |
| | SLO-2 | *Polyalphabetic Ciphers, One-Time Pad* | *Key generation* | *Key Rings* | *Secure Socket Layer* | *Diffie-Hellman Key Exchange algorithm* |
| S-13 | SLO-1 | *Overview of Transposition Techniques* | *Principles of Public-Key Cryptosystems* | *S/MIME Functionality* | *Transport Layer Security* | *Firewall Design Principles* |
| | SLO-2 | *Steganography* | *The RSA Algorithm* | *S/MIME Messages, Certificate processing* | *Secure Electronic Transaction* | *Trusted Systems* |
| S 14-15 | SLO-1 | *Laboratory 3: iii) Hill Cipher* | *Laboratory 6: ii. Row & Column Transformation* | *Laboratory 9: Calculate the message digest of a text using the SHA-1 algorithm.* | *Laboratory 7: example on RSA* | *Laboratory 15: Implement the Diffie-Hellman Key Exchange algorithm* |

| **Learning Resources** | |
|---|---|
| | 1. Anderson B.H., Dursaton and Poole, M : Thesis and assignment writing, Wiley Eastern 1997<br>2. Bordens, K. S. and Abbott, B.B : Research design and Methods, Mc Graw Hill, 2008<br>3. Leedy, P. . : Practical Research – Planning and design, Ninth Edition, Pearson, 2010 |
| | 4. Walpole, R.A., Myers, R.H., Myers, S.L. and Ye, King : Probability and Statistics for Engineers and Scientists, Pearson Prentice Hall, Pearson Education Inc., 2012<br>5. Kothari, C.K. [2004], 2.e, Research Methodology – Methods and Technique3s [New Age International, New Delhi]<br>6. Ganesan R, Research Methodology for Engineers , MJP Publishers, Chennai. 2016 |

**Learning Assessment**

| Bloom's Level of Thinking | | Continous Learning Assessment(50% Weightage) | | | | | | | | Final Examination (50% weightage) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4# (10%) | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100% | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc

| **Course Designers** | | |
|---|---|---|
| **Experts from Industry** | **Experts from Higher Technical Institutions** | **Internal Experts** |
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr.S.Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | Dr Kalpana |
| | | Mrs.P.Yogalakshmi |

| Course Code | PCS21E09J | Course Name | COMPILER DESIGN | Course Category | D | Discipline Elective Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 | 0 | 2 | 4 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Engineering Knowledge | Problem Analysis | Design & Development | Analysis, Design, Research | Modern Tool Usage | Society & Culture | Environment & Sustainability | Ethics | Individual & Team Work | Communication | Project Mgt. & Finance | Life Long Learning | PSO - 1 | PSO - 2 | PSO – 3 |
| CLR-1 : | *Utilize the mathematics and engineering principles for the Design of Compilers* | | | | | | | | | | | | | | | | | | |
| CLR-2 : | *Acquire knowledge of Lexical Analyzer from a specification of a language's lexical rules* | | | | | | | | | | | | | | | | | | |
| CLR-3 : | *Acquire knowledge of Syntax Analyzer for parsing the sentences in a compiler grammar* | | | | | | | | | | | | | | | | | | |
| CLR-4 : | *Gain knowledge to translate a system into various intermediate codes* | | | | | | | | | | | | | | | | | | |
| CLR-5 : | *Analyze the methods of implementing a Code Generator for compilers* | | | | | | | | | | | | | | | | | | |
| CLR-6 : | *Analyze and Design the methods of developing a Code Optimizer* | | | | | | | | | | | | | | | | | | |
| **Course Learning Outcomes (CLO):** | At the end of this course, learners will be able to: | | | | | | | | | | | | | | | | | | |
| CLR-1 : | *Utilize the mathematics and engineering principles for the Design of Compilers* | 3 | 80 | 70 | H | H | H | H | M | | | | | | | | | | |
| CLR-2 : | *Acquire knowledge of Lexical Analyzer from a specification of a language's lexical rules* | 3 | 85 | 75 | H | H | H | H | M | | | | | | | | | | |
| CLR-3 : | *Acquire knowledge of Syntax Analyzer for parsing the sentences in a compiler grammar* | 3 | 75 | 70 | H | H | H | H | M | | | | | | | | | | |
| CLR-4 : | *Gain knowledge to translate a system into various intermediate codes* | 3 | 85 | 80 | H | H | H | H | M | | | | | | | | | | |
| CLR-5 : | *Analyze the methods of implementing a Code Generator for compilers* | 3 | 85 | 75 | H | H | H | H | M | | | | | | | | | | |
| CLR-6 : | *Analyze and Design the methods of developing a Code Optimizer* | 3 | 80 | 70 | H | H | H | H | M | | | | | | | | | | |

| Duration (hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Compilers – Analysis of the source program* | *Syntax Analysis Definition - Role of parser* | *Bottom Up Parsing* | *Intermediate Code Generation* | *Code optimization* |
| | SLO-2 | *Phases of a compiler – Cousins of the Compiler* | *Lexical versus Syntactic Analysis* | *Reductions* | *Intermediate Languages - prefix - postfix* | *Introduction– Principal Sources of Optimization* |
| S-2 | SLO-1 | *Grouping of Phases – Compiler construction tools* | *Representative Grammars* | *Handle Pruning* | *Quadruple - triple - indirect triples Representation* | *Function Preserving Transformation* |
| | SLO-2 | *Lexical Analysis – Role of Lexical Analyzer* | *Syntax Error Handling* | *Shift Reduce Parsing* | *Syntax tree- Evaluation of expression - three-address code* | *Loop Optimization* |
| S-3 | SLO-1 | *Input Buffering* | *Elimination of Ambiguity, Left Recursion* | *Problems related to Shift Reduce Parsing* | *Synthesized attributes – Inherited attributes* | *Optimization of basic Blocks* |
| | SLO-2 | *Specification of Tokens* | *Left Factoring* | *Conflicts During Shift Reduce Parsing* | *Intermediate languages – Declarations* | *Building Expression of DAG* |
| S 4-5 | SLO-1 | *Laboratory 1: Implementation of Lexical Analyzer* | *Laboratory 4:Elimation of Ambiguity, Left Recursion and Left Factoring* | *Laboratory 7 : Shift Reduce Parsing* | *Laboratory 10:Intermediate code generation – Postfix, Prefix* | *Laboratory 13:Implementation of DAG* |
| | SLO-2 | | | | | |
| S-6 | SLO-1 | *Finite automation - deterministic* | *Top down parsing* | *LR Parsers- Why LR Parsers* | *Assignment Statements* | *Peephole Optimization* |
| | SLO-2 | *Finite automation - non deterministic* | *Recursive Descent Parsing, back tracking* | *Items and LR(0) Automaton, Closure of Item Sets,* | *Boolean Expressions, Case Statements* | *Basic Blocks, Flow Graphs* |
| S-7 | SLO-1 | *Transition Tables* | *Computation of FIRST* | *LR Parsing Algorithm* | *Back patching – Procedure calls* | *Next -Use Information* |

| Duration (hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| | SLO-2 | *Acceptance of Input Strings by Automata* | *Problems related to FIRST* | *Operator Precedence Parser Computation of LEADING* | *Code Generation* | *Introduction to Global Data Flow Analysis* |
| S-8 | SLO-1 | *State Diagrams and Regular Expressions* | *Computation of FOLLOW* | *Computation of TRAILING* | *Issues in the design of code generator* | *Computation of gen and kill* |
| | SLO-2 | *Conversion of regular expression to NFA – Thompson's* | *Problems related to FOLLOW* | *Problems related to LEADING AND TRAILING* | *The target machine – Runtime Storage management* | *Computation of in and out* |
| S 9-10 | SLO-1 | *Laboratory 2: conversion from Regular Expression to NFA* | *Laboratory 5:FIRST AND FOLLOW computation* | *LaboratoryLab 8: Computation of LEADING AND TRAILING* | *Laboratory 11: Intermediate code generation – Quadruple, Triple, Indirect triple* | *Laboratory 14 : Implementation of Global Data Flow Analysis* |
| | SLO-2 | | | | | |
| S-11 | SLO-1 | *Conversion of NFA to DFA* | *Construction of a predictive parsing table* | *SLR Grammars* | *A simple Code generator* | *Parameter Passing.* |
| | SLO-2 | *Simulation of an NFA* | *Predictive Parsers LL(1) Grammars* | *SLR Parsing Tables* | *Code Generation Algorithm* | *Runtime Environments* |
| S-12 | SLO-1 | *Converting Regular expression directly to DFA* | *Transition Diagrams for Predictive Parsers* | *Problems related to SLR* | *Register and Address Descriptors* | *Source Language issues* |
| | SLO-2 | *Minimization of DFA* | *Error Recovery in Predictive Parsing* | *Construction of Canonical LR(1) and LALR* | *Generating Code of Assignment Statements* | *Storage Organization* |
| S-13 | SLO-1 | *Minimization of NFA* | *Predictive Parsing Algorithm* | *Construction of LALR* | *Cross Compiler – T diagrams* | *Activation Records* |
| | SLO-2 | *Design of lexical analysis (LEX)* | *Non Recursive Predictive Parser* | *Problems related to Canonical LR(1) and LALR Parsing Table* | *Issues in Cross compilers* | *Storage Allocation strategies* |
| S 14-15 | SLO-1 | *Laboratory 3: Conversion from NFA to DFA* | *Laboratory 6 :Predictive Parsing Table* | *Laboratory9 : Computation of LR(0) items* | *Laboratory12 : A simple code Generator* | *Laboratory 15: Implement any one storage allocation strategies(heap, stack, static)* |
| | SLO-2 | | | | | |

| **Learning Resources** | |
|---|---|
| 1. AlfredVAho,JefferyDUllman,RaviSethi,"Compilers,Principlestechniquesandtools",Pearson Education2011<br>2. S.GodfreyWinster,S.ArunaDevi,R.Sujatha,"CompilerDesign",YesdeePublishingPvt.Ltd,2016<br>3. WilliamM.WaiteandGerhardGoos.CompilerConstruction.Springer-Verlag,New York,2013. | 4. K.Muneeswaran,,"CompilerDesign",OxfordHigherEducation,Fourthedition2015<br>5. DavidGalles,"ModernCompilerDesign",PearsonEducation,Reprint2012.<br>6. RaghavanV.,"PrinciplesofCompilerDesign",TataMcGrawHillEducationPvt.Ltd.,2010 |

**Learning Assessment**

| Bloom's Level of Thinking | | Continous Learning Assessment(50% Weightage) | | | | | | | | Final Examination (50% weightage) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4# (10%) | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100% | |

**# CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,**

| **Course Designers** | | |
|---|---|---|
| **Experts from Industry** | **Experts from Higher Technical Institutions** | **Internal Experts** |
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr. S. Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | Dr.S.P.Angelin Claret |
| | | Mrs.P.Yogalakshmi |

| Course Code | PCS21G01J | Course Name | DEEP LEARNING FOR DATA SCIENCE | Course Category | G | Generic Elective Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 | 0 | 2 | 4 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to, | Learning | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| CLR-1 : | *Develop knowledge of Neural Network* | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) |
| CLR-2 : | *Understand and analyze deep learning* | | | |
| CLR-3 : | *Perform Optimization Techniques* | | | |
| CLR-4 : | *Implement Deep Learning models* | | | |
| CLR-5 : | *Get Familiar with Keras library* | | | |
| CLR-6 : | *Implement Deep Q-Learning* | | | |

| Course Learning Outcomes (CLO): | At the end of this course, learners will be able to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Fundamental Knowledge | Application of Concepts | Link with Related Disciplines | Procedural Knowledge | Skills in Specialization | Ability to Utilize Knowledge | Skills in Modeling | Analyze, Interpret Data | Investigative Skills | Problem Solving Skills | Communication Skills | Analytical Skills | PSO 1 | PSO 2 | PSO 3 |
| CLO-1 : | *Build a Perceptron model* | 2 | 85 | 80 | H | H | H | H | H | H | - | | | | | | | | |
| CLO-2 : | *Build Neural Network model using BP algorithm* | 3 | 85 | 80 | L | H | H | H | H | H | - | | | | | | | | |
| CLO-3 : | *Using Pytorch to build a prediction model* | 3 | 85 | 80 | L | H | H | H | H | H | - | | | | | | | | |
| CLO-4 : | *Fine Tuning the Deep Learning models for performance optimization* | 3 | 85 | 80 | L | H | H | H | H | H | - | | | | | | | | |
| CLO-5 : | *Build, Compile, Test, and evaluate model in Keras* | 3 | 85 | 80 | L | H | H | H | H | H | - | | | | | | | | |
| CLO-6 : | *Work with Generative Adversarial Networks* | 3 | 85 | 80 | L | H | H | H | H | H | - | | | | | | | | |

| Duration (hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Introduction to Neural Network* | *Fine Tuning NN models ANN Processing Components* | *Fine Tuning NN Models What is Fine Tuning?* | *Keras and DL Overview of TFMA* | *Interactive Applications of DL* |
| | SLO-2 | *Fundamentals* | *Learning and Training in ANN* | *Regularization* | *Practical Consideration for DL* | *Machine Vision – CNN* |
| S-2 | SLO-1 | *Biological NN Vs ANN* | *Cluster analysis in ANN* | *What is Vector Quantization?* | *DL parameters* | *Pooling Layers* |
| | SLO-2 | *ANN Architecture* | *NN Building blocks* | *The Encoder-Decoder Model* | *Data Loading and Preprocessing* | *Lenet-5 in Keras* |
| S-3 | SLO-1 | *Computational Models in NN Neurons Interconnection* | *Perceptron to Deep NN Model and Hyper parameters* | *The Generalized Lloyd Algorithm Relation between SOM and noisy encoder-decoder* | *Data Preprocessing with Keras Keras Layers* | *Alexnet and vggnet in keras Natural Language processing* |
| | SLO-2 | *Threshold Functions Activation functions & ANN* | *Classification with NN Deep Learning Frameworks* | *Voronoi Tesselation LVQ Introduction* | *Training Models with fit() Monitoring Performance Metrics* | *Creating word embeddings with word2vec Natural Language Classification with familiar networks* |
| S 4-5 | SLO-1 | *Laboratory 1: Implement a Feed Forward Neural Network with Back propagation training algorithm for realizing XOR problem* | *Laboratory 4: Build a NN model using PyTorch* | *Laboratory 7: Implement LVQ Network for Pattern Classification* | *Laboratory 10: Build a model for Credit Card Fraudulence Detection* | *Laboratory 13: Build a CNN model for Image Classification* |
| | SLO-2 | | | | | |
| S-6 | SLO-1 | *Implementing Neural Networks Building Neural Networks Models* | *NN Categorization* | *The LVQ Algortihm* | *Checkpointing* | *Generative Adversarial Networks* |

| Duration (hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| | SLO-2 | *Use case of ANN* | *NN Computational Model* | *The LVQ2 Algorithm* | *Debugging the model with eager execution* | *Essential GAN Theory* |
| S-7 | SLO-1 | *Perceptrons* | *NN Building Components* | *Hebbian Learning* | *Speed Up process with multiple GPUs* | *The Discriminator Network* |
| | SLO-2 | *Single Layer Perceptron Model* | *Evolutionary Algorithm & Gradient Descent* | *Hebbian Learning Rule* | *Multiple GPU and distributed trainings* | *The Generator Network* |
| S-8 | SLO-1 | *Least Mean Square Algorithm* | *Object Image Classification* | *Competitive Learning* | *Transfer Learning* | *The Adversarial Network* |
| | | *Learning Curves* | *Learning rates and Optimization* | *Optimizing NN* | *Image classification* | *GAN Training* |
| | SLO-2 | *Learning Rates* | *Optimizing Speed* | *Debugging NN* | *Keras Metrics* | *Reinforcement Learning* |
| | | *Perceptron* | *Dense Network Tuning using Hyper parameters* | *Learning rate optimization* | *Jupyter notebooks* | *Reinforcement Learning Process steps* |
| S 9-10 | SLO-1 | *Laboratory 2: Implement a Perceptron in Python* | *Laboratory 5: Implement ANN Training in Python for MNIST Digit Classification problem* | *Laboratory 8: Using Keras, perform rate adaption schedule.* | *Laboratory 11: Work on a text classification problem with Keras API* | *Laboratory 14: Design and build a Game environment* |
| | SLO-2 | | | | | |
| S-11 | SLO-1 | *Multilayer Perceptron* | *Linear Model with Estimators* | *Optimizing Networks* | *Dataset for NN* | *Deep Reinforcement Learning Applications* |
| | SLO-2 | *The XOR Problem* | *NN for Predictions* | *Rate adaption schedule* | *Exploring the Dataset* | *Deep RL Use cases* |
| S-12 | SLO-1 | *Back Propagation Algorithm, Heuristics for improving BP algorithm* | *Optimization approaches for prediction, NN algorithms* | *Scaling, Scaling methods* | *Preparing the dataset, Visualizing the dataset* | *Deep-Q Learning Introduction, The DQN Agent* |
| | SLO-2 | *Radial Basis Function Networks, Interpolation* | *Data preparation for NN, ANN Training in python* | *Batch Normalization, Mini Batch Normalization* | *Compiling the model, Training the NN* | *Q-Learning, Deep Q Learning* |
| S-13 | SLO-1 | *Regularization* | *Training Samples* | *Internal Covariate Shift* | *Testing the NN* | *Steps in Deep Q Learning* |
| | SLO-2 | *Learning Strategies* | *Overfitting and Underfitting* | *Implement Gradient learning* | *Evaluate the model* | *Experience Replay* |
| S 14-15 | SLO-1 | *Laboratory 3: Implement a Feed Forward Neural Network with Back propagation training algorithm for realizing Straight line e.g. y = 2x + 3* | *Laboratory 6: Perform Hyper parameter tuning in the ANN model implemented in Lab 5* | *Laboratory 9: Implement Batch Normalization and gauge its performance* | *Laboratory 12: Build a DL model for diabetes classification problem* | *Laboratory 15:Build and Train the Deep Q Neural Network* |
| | SLO-2 | | | | | |

| **Learning Resources** | 1. Deep Learning with Python,By Francois Chollet, December 2017<br>2. Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence,By Jon Krohn, Grant Beyleveld and Aglaé Bassens, September 2019 | 3. Hugo Larochelle's Video Lectures on Deep Learning<br>4. Introduction to Deep Learning by Sandro Skansi, Springer, 2018<br>**5.** Deep Learning withTensorFlow 2 and Keras - Second Edition,By Antonio Gulli, Amita Kapoor and Sujit Pal, December 2019 |
|---|---|---|

**Learning Assessment**

| Bloom's Level of Thinking | | Continous Learning Assessment(50% Weightage) | | | | | | | | Final Examination (50% weightage) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4# (10%) | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100% | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

| Course Designers | | |
|---|---|---|
| **Experts from Industry** | **Experts from Higher Technical Institutions** | **Internal Experts** |
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr.S.Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | Ms. Yogalakshmi |
| | | Dr.P.Muthulakshmi |

| Course Code | PCS21G02J | Course Name | SOFTWARE ENGINEERING | Course Category | G | Generic Elective Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 | 0 | 2 | 4 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to, | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| CLR-1 : | *Familiarize the software lifecycle models and software development process* | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Disciplinary Knowledge | Critical Thinking | Problem Solving | Analytical Reasoning | Research Skills | Team Work | Scientific Reasoning | Reflective Thinking | Self-Directed Learning | Multicultural Competence | Ethical Reasoning | Community Engagement | PSO 1 | PSO 2 | PSO 3 |
| CLR-2 : | *Understand the various techniques for requirements, planning and managing a technology project* | | | | | | | | | | | | | | | | | | |
| CLR-3 : | *Examine basic methodologies for software design, development, testing, closure and implementation* | | | | | | | | | | | | | | | | | | |
| CLR-4 : | *Understand manage users expectations and the software development team* | | | | | | | | | | | | | | | | | | |
| CLR-5 : | *Acquire the latest industry knowledge, tools and comply to the latest global standards for project management* | | | | | | | | | | | | | | | | | | |
| **Course Learning Outcomes (CLO):** | At the end of this course, learners will be able to: | | | | | | | | | | | | | | | | | | |
| CLO-1 : | *Identify the process of life cycle model and process project* | 3 | 80 | 70 | L | H | - | H | L | - | - | - | | | | | - | - | - |
| CLO-2 : | *Analyze and specify software requirements through a productive working Relationship with project stakeholders* | 3 | 85 | 75 | M | H | L | M | L | - | - | - | | | | | - | - | - |
| CLO-3 : | *Design the system based on Functional Oriented and Object Oriented Approach for Software Design.* | 3 | 75 | 70 | M | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-4 : | *Develop the correct and robust code for the software products* | 3 | 85 | 80 | M | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-5 : | *Perform by applying the test plan and various testing techniques* | 3 | 85 | 75 | H | H | M | H | L | - | - | - | | | | | - | - | - |

| Duration(Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Introduction to software Engineering* | *System Engineering* | *Introduction to Testing* | *Project Management Spectrum* | *Risk Management* |
| | SLO-2 | *Characteristics of software* | *Components of System Engineering* | *Definition , Characteristics of Testing* | *Four P's* | *Reactive and Proactive Risk Strategies* |
| S2 | SLO-1 | *The Changing Nature of software* | *Requirements Engineering Tasks* | *Testing Strategies for Conventional Software* | *The People and the Product* | *Software Risks* |
| | SLO-2 | *Legacy Software and Software myths* | *Process, Initiating and Eliciting requirements.* | *Unit testing and Integration testing* | *Role of People* | *Risk Identification and Risk Projection* |
| S3 | SLO-1 | *A Generic view of process Software Engineering* | *Building the Analysis Model* | *Validation Testing* | *The Process and the Project* | *Risk refinement* |
| | SLO-2 | *A layered Technology* | *Analysis Modeling Approaches* | *Verification Vs Validation* | *Role of Process* | *Risk Mitigation* |
| S4 –5 | SLO-1 | *Laboratory1:Identifing Project Objective and Scope* | *Laboratory 4:Project Planning* | *Laboratory 7: Function Oriented Diagram* | *Laboratory 10:Test Case design for unit testing* | *Laboratory 13: Preparation of Timeline charts and Tracking the Scheduling* |
| | SLO-2 | | | | | |
| S6 | SLO-1 | *A process framework* | *Data Modeling Concepts* | *System Testing* | *Metrics for Process and Projects-Estimation* | *Monitoring and Management* |
| | SLO-2 | *Capability Maturity Model Integration* | *Example Diagram* | *Non-Functional testing* | *LOC, FP, Object Oriented.* | *Example* |
| S7 | SLO-1 | *Process Models* | *Scenario based Modeling* | *Debugging Process* | *Estimation* | *Quality Concepts* |
| | SLO-2 | *Water fall , RAD model* | *USE-CASE Diagram* | *Testing Tactics* | *Estimation models* | *SQA Activities* |
| S8 | SLO-1 | *Iterative Process Models* | *Flow Oriented Modeling* | *White Box Testing, Basic-Path testing* | *The Project Planning Process* | *Software Reviews and FTR* |
| | SLO-2 | *Incremental ,Prototype and Spiral* | *Data Flow Diagram* | *Cyclomatic complexity calculation* | *Resources* | *Statistical Quality Assurance* |
| S9-10 | SLO-1 | *Laboratory 2:Selection of Suitable* | *Laboratory 5:Performing Various* | *Laboratory 8:User's View Analysis* | *Laboratory 11:Test Case design for* | *Laboratory 14: Estimation of Effort and* |

| Duration(Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| | SLO-2 | *software process Model of the suggested system* | *Requirement Analysis* | | *Integration testing* | *Risk Identification* |
| S-11 | SLO-1 | *Prescriptive models* | *Design Engineering* | *Black Box Testing* | *Decomposition Techniques* | *The Software Configuration Management* |
| | SLO-2 | *Phases of the model* | *Example* | *Equivalence Partitioning* | *calculations of Decomposition techniques* | *SCM Repository* |
| S-12 | SLO-1 | *Specialized Process Models* | *Software Design Concepts* | *BVA , Error Guessing* | *Empirical Estimation Models* | *Business Process Reengineering* |
| | SLO-2 | *The Unified Process Model* | *Example Diagrams* | *Cause-Effect Graphing* | *COCOMO model* | *Reengineering Diagram and Example.* |
| S-13 | SLO-1 | *An agile view of Process* | *The Design Model* | *Testing for Specialized Environments* | *Project Scheduling Concepts* | *Reverse Engineering* |
| | SLO-2 | *Case study on Best SDLC selection based on the Scenario* | *Examples for all designs* | *Preparation of Test case Plan and Report* | *Examples* | *Forward Engineering* |
| S14-15 | SLO-1<br>SLO-2 | *Laboratory 3:Problem Statement Preparation* | *Laboratory 6:Develop Software Requirement Specification Sheet (SRS)* | *Laboratory 9:Structure view diagram* | *Laboratory12:Perforing Testing and Debugging for a sample code* | *Laboratory 15: Software Quality Assurance Components.* |

| | |
|---|---|
| **Learning Resources** | 1. Roger, S. Pressman (2004), Software Engineering: A Practitioner Approach, McGraw Hill International Edition, Sixth Edition, New Delhi<br>2. Waman, S Jawadekar (2004), Software Engineering: Principles and Practice, McGraw Hill Education Pvt. Limited, New Delhi.<br>3. RohitKhurana (2011), Software Engineering-Principles and Practices, Vikas Publishing House Pvt. Ltd., Second Edition, New Delhi.<br>4. Chairperson, Counting Practices Committee, Valerie Marthaler, EDS, Troy, Michigan, Function Point Counting Practices Manual Release 4.1.1, The International Function Point User Group, April 2000.<br>5. Carlo Ghezzi, Mehdi Jazayari, Dino Mandrioli (1991), Fundamentals of Software Engineering, Prentice Hall of India, New Delhi. |

**Learning Assessment**

| Bloom's Level of Thinking | | Continous Learning Assessment(50% Weightage) | | | | | | | | Final Examination (50% weightage) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4# (10%) | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100% | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc

**Course Designers**

| Experts from Industry | Experts from Higher Technical Institutions | Internal Experts |
|---|---|---|
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr.S.Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | Dr.Kanchana<br>Dr.Kalpana |

| Course Code | PCS21G03J | Course Name | RESEARCH METHODOLOGY | Course Category | G | Generic Elective Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 | 0 | 2 | 4 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: |
|---|---|
| CLR-1 : | *To become familiar with objective of research* |
| CLR-2 : | *To get exposed to resources for research* |
| CLR-3 : | *To learn art of writing and presentation* |
| CLR-4 : | *To study about the data collection* |
| CLR-5 : | *To learn about analysis and inference* |

| Course Learning Outcomes (CLO): | At the end of this course, learners will be able to: | Learning | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) |
| CLO-1 : | *Have a thorough understanding of steps involved in research preparation and planning* | 3 | 80 | 70 |
| CLO-2 : | *Perform literature review and case study* | 3 | 85 | 75 |
| CLO-3 : | *Learn the basics of academic writing and presentation* | 3 | 75 | 70 |
| CLO-4 : | *Learn the basics of data collection* | 3 | 85 | 80 |
| CLO-5 : | *Knowledge about analysis and inference* | 3 | 85 | 75 |

| Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| Fundamental Knowledge | Application of Concepts | Link with Related Disciplines | Procedural Knowledge | Skills in Specialization | Ability to Utilize Knowledge | Skills in Modeling | Analyze, Interpret Data | Investigative Skills | Problem Solving Skills | Communication Skills | Analytical Skills | PSO 1 | PSO 2 | PSO 3 |
| L | H | - | H | L | - | - | - | | | | | - | - | - |
| M | H | L | M | L | - | - | - | | | | | - | - | - |
| M | H | M | H | L | - | - | - | | | | | - | - | - |
| M | H | M | H | L | - | - | - | | | | | - | - | - |
| H | H | M | H | L | - | - | - | | | | | - | - | - |

| Duration (Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Objectives of research* | *Literature search* | *Proposal submission for funding agencies* | *Basic statistical distributions* | *Large sample tests* |
| | SLO-2 | *Understanding research and its goals* | *Online data bases* | *Elements of Style* | *Basic statistical distributions and their applications:* | *small sample tests* |
| S-2 | SLO-1 | *Objectives of research* | *search tools* | *Basic knowledge of funding agencies* | *Binomial* | *Student t-test* |
| | SLO-2 | *Critical thinking* | *Online data bases* | *More about funding agencies* | *Features of Binomial* | *F test* |
| S-3 | SLO-1 | *Techniques for generating research topics* | *trustworthiness* | *Proposal submission for funding agencies* | *Poisson* | *$\chi$ 2 test and their applications in research studies* |
| | SLO-2 | *Topic slection* | *Methods of Dispersion* | *Elements of Style* | *Non parametric test* | *Descriptive statistics for one variable* |
| S4-5 | SLO-1 | *Lab 1: Construction of Frequency Table* | *Lab 4:Calculation of Methods of Dispersion* | *Lab 7:Test of Significance for single and two samples* | *Lab 10: Non Parametric Test* | *Lab 13: Descriptive statistics for one variable* |
| | SLO-2 | | | | | |
| S-6 | SLO-1 | *Topic justification* | *Citation in dices* | *Research report writing, Communication skills* | *Normal* | *Correlation and Regression analysis* |
| | SLO-2 | *Techniques involved in designing a questionnaire* | *Principles underlying impact factor* | *Tailoring the presentation to the target audience* | *ANOVA* | *Time series analysis :* |
| S-7 | SLO-1 | *Methods of scientific enquiry* | *Literature review* | *Oral presentations* | *Exponential* | *Forecasting methods Factor anlaysis* |
| | SLO-2 | *Discuss about hypothese* | *Case studies* | *Poster preparations* | *Weibull* | *Cluster analysis* |

| Duration (Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| S-8 | SLO-1 | *Formuation of hypotheses* | *Feature of case studies* | *Communication skills* | *anGeometric distributions* | *discriminant analysis (Basic ideas only)* |
| | SLO-2 | *Graphical representation of data* | *Skewness* | *Discuss about the Deviation* | *Two way ANOVA* | *Inferential statistics* |
| S9-10 | SLO-1 | *Lab 2: Graphical representation of data* | *Lab 5: Skewness* | *Lab 8: Deviation from Stability Deviation from Normality* | *Lab 11: Two way ANOVA* | *Lab 14: Explore command Inferential statistics for one variable* |
| | SLO-2 | | | | | |
| S-11 | SLO-1 | *hypotheses testing of the same* | *review articles* | *Submission of research articles for Publication in Reputed journal* | *Sample size determination* | *Principles of Experimentation* |
| | SLO-2 | *Preparation of the research proposal* | *Meta-analysis* | *Thesis writing* | *sampling techniques* | *Basic Experimental designs* |
| S-12 | SLO-1 | *Development of a research proposal* | *Role of the librarian* | *Research report writing* | *Random sampling* | *Completely Randomized Design* |
| | SLO-2 | *Sources of information* | *Ethical Research* | *Elements of excellent presentation* | *stratified sampling* | *Randomized Block Design* |
| S-13 | SLO-1 | *Steps of research process* | *moral issues in Research* | *preparation, visual and delivery* | *systematic sampling* | *Latin Square Design* |
| | SLO-2 | *Different types of Graphs* | *Plagiarism- Tools to avoid plagiarism* | *Oral communication skills and oral defence.* | *cluster sampling* | *Factorial Designs : $2^2$, $2^3$ and $2^4$* |
| S 14-15 | SLO-1 | *Lab 3: Different types of Graphs* | *Lab 6: Calculation of correlation coefficient* | *Lab 9: Small Sample Test* | *Lab 12:Test of Homogenity of means for more than two samples* | *Lab 15:Simpile Linear Regression* |
| | SLO-2 | | | | | |

| **Learning Resources** | |
|---|---|
| | 1. Anderson B.H., Dursaton and Poole, M : Thesis and assignment writing, Wiley Eastern 1997<br>2. Bordens, K. S. and Abbott, B.B : Research design and Methods, Mc Graw Hill, 2008<br>3. Leedy, P. . : Practical Research – Planning and design, Ninth Edition, Pearson, 2010 |
| | 4. Walpole, R.A., Myers, R.H., Myers, S.L. and Ye, King : Probability and Statistics for Engineers and Scientists, Pearson Prentice Hall, Pearson Education Inc., 2012<br>5. Kothari, C.K. [2004], 2.e, Research Methodology – Methods and Technique3s [New Age International, New Delhi]<br>6. Ganesan R, Research Methodology for Engineers, MJP Publishers, Chennai. 2016 |

**Learning Assessment**

| Bloom's Level of Thinking | | Continous Learning Assessment(50% Weightage) | | | | | | | | Final Examination (50% weightage) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4# (10%) | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100% | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc

| **Course Designers** | | |
|---|---|---|
| **Experts from Industry** | **Experts from Higher Technical Institutions** | **Internal Experts** |
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr.S.Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | Dr Kanchana |
| | | Mr.Ramesh |

| Course Code | PCS21E31L | Course Name | MINI PROJECT | Course Category | P | Project Work | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 0 | 0 | 2 | 1 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | | As required for the project work | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: | Learning | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) |
| CLR-1 : | *CLR-1 : To prepare the student to gain major design and or research experience as applicable to the profession* | | | |
| CLR-2 : | *Apply knowledge and skills acquired through earlier course work in the chosen project* | | | |
| CLR-3 : | *Make conversant with the codes, standards , application software and equipment* | | | |
| CLR-4 : | *Carry out the projects within multiple design constraints* | | | |
| CLR-5 : | *Incorporate multidisciplinary components* | | | |
| CLR-6 : | *Acquire the skills of comprehensive report writing* | | | |

| Course Learning Outcomes (CLO): | At the end of this course, learners will be able to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Fundamental Knowledge | Application of Concepts | Link with Related Disciplines | Procedural Knowledge | Skills in Specialization | Ability to Utilize Knowledge | Skills in Modeling | Analyze, Interpret Data | Investigative Skills | Problem Solving Skills | Communication Skills | Analytical Skills | PSO 1 | PSO 2 | PSO 3 |
| CLO-1 : | *Design a system* | 3 | 80 | 70 | L | H | - | H | L | - | - | - | | | | | - | - | - |
| CLO-2 : | *Process or gain research insight into a defined problem* | 3 | 85 | 75 | M | H | L | M | L | - | - | - | | | | | - | - | - |
| CLO-3 : | *Solution to the problem as would be encountered in professional manner* | 3 | 75 | 70 | M | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-4 : | *Problem solving - its impacton global, economic, environmental and social context.* | 3 | 85 | 80 | M | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-5 : | *Practice software project phases* | 3 | 85 | 75 | H | H | M | H | L | - | - | - | | | | | - | - | - |
| CLO-6 : | *Implementation* | 3 | 80 | 70 | L | H | - | H | L | - | - | - | | | | | - | - | - |

The assessment method for the project work consists of in-semester and end semester evaluations as detailed below:

| | Continuous Learning Assessment (50% weightage) | | | | Final Evaluation (50% weightage) | |
|---|---|---|---|---|---|---|
| | Regularity & Discipline | Review – 1 | Review – 2 | Review – 3 | Project Report | Viva-Voce* |
| Mini Project | 10% | 10% | 10% | 20% | 20 % | 30 % |

*Student has to be present for the viva voce for assessment. Otherwise it will be treated as non-appearance for the examination with final grade as 'Ab'

| Course Code | PCS21S03J | Course Name | WEB DEVELOPMENT USING ANGULARJS AND MONGO | Course Category | S | Skill Enhancement Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3 | 0 | 2 | 4 |

| Pre-requisite Courses | HTML BASICS | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | Nil | | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Engineering Knowledge | Problem Analysis | Design & Development | Analysis, Design, Research | Modern Tool Usage | Society & Culture | Environment & Sustainability | Ethics | Individual & Team Work | Communication | Project Mgt. & Finance | Life Long Learning | PSO - 1 | PSO - 2 | PSO – 3 |
| CLR-1 : | *Create single page applications and understand the functional behavior of dynamic web pages* | | | | | | | | | | | | | | | | | | |
| CLR-2 : | *Understand presentation components that look like HTML elements* | | | | | | | | | | | | | | | | | | |
| CLR-3 : | *Build corner to corner interactive components in dynamic web pages* | | | | | | | | | | | | | | | | | | |
| CLR-4 : | *Understand MVC framework/architecture of web programming/client-server architecture* | | | | | | | | | | | | | | | | | | |
| CLR-5 : | *Build synchronized objects across view and model components* | | | | | | | | | | | | | | | | | | |
| CLR-6 : | *Learn the Fundamentals of MongoDB* | | | | | | | | | | | | | | | | | | |
| **Course Learning Outcomes (CLO):** | At the end of this course, learners will be able to: | | | | | | | | | | | | | | | | | | |
| CLO-1 : | *Make use of expressions, do data binding with external components* | 3 | 90 | 90 | | H | L | M | M | H | - | - | - | - | - | - | - | | |
| CLO-2 : | *Distinguish the role of MVC in creating dynamic web applications* | 3 | 90 | 90 | | H | M | M | M | H | - | - | - | - | - | - | - | | |
| CLO-3 : | *Understand the role of reusability and data encapsulation in the form of objects* | 3 | 85 | 85 | | H | M | M | M | H | - | - | - | - | - | - | - | | |
| CLO-4 : | *Distinguish RDBMS and schema design of MongoDB* | 4 | 90 | 90 | | H | M | M | M | H | - | - | - | - | - | - | - | | |
| CLO-5 : | *Perform query operations using MongoDB* | 3 | 90 | 90 | | H | M | M | M | H | - | - | - | - | - | - | - | | |
| CLO-6 : | *Understand and build logical relationships between documents using MongoDB* | 4 | 85 | 85 | | H | H | H | H | H | - | - | - | - | - | - | - | | |

| Duration (Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Introduction of Scripting Language* | *Arrays Introduction and Declaring and Accessing arrays* | *Angular Js Expressions,* | *Angular JS Scope* | *Document with different types of values i)Document with Scalar Values* |
| | SLO-2 | *Difference between client and server side scripting.* | *Array Properties : index, input, length, prototype* | *Angular JS Numbers , Angular JS Strings* | *Understanding the scope* | *ii)Document with Documents as values iii)Document with Array as values* |
| S-2 | SLO-1 | *Script tag in HTML* | *Array Methods :concat, every, forEach, educe, reverse* | *Angular JS Object , Angular JS Arrays* | *Angular JS Filters* | *CRUD operation :Insert Operation i)insertOne() and ii)insertMany() with examples.* |
| | SLO-2 | *Java script declaration* | *Array Methods :indexOf, join, lastIndexOf, toString, slice, some, sort* | *Angular JS Expressions vs Java Script Expressions* | *Adding Filters to Directives* | *Perform Query Operation for the following situations i)Query on nested documents ii)Query an array ii)Query an array of nested documents iv)Geospatial Queries Query Operation Examples* |
| S-3 | SLO-1 | *Output Printing and Input methods* | *Function Definition and Parameters* | *Angular JS Application* | *Filter an Array Based on User Input and Sorting an Array based on User input* | *Update Operation: updateOne(), updateMany()* |
| | SLO-2 | *Java script statements,* | *Calling a Function* | *Angular JS Modules* | *Custom Filters* | *replaceOne(), findAndModify() Update operation :Examples* |
| S 4-5 | SLO-1 | *Laboratory 1: Java Script Input and Output* | *Laboratory 4 : Functions* | *Laboratory 7: Angular Js program Using Controllers* | *Laboratory 10: Angular Js program using filters* | *Laboratory 13: Working with CURD operations Insert and Query* |
| | SLO-2 | | | | | |

| Duration (Hour) | | 15 | 15 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|
| S-6 | SLO-1 | *Java Script Comments and Variables* | *Function Return Statement* | *Angular JS Controller* | *Angular Service $http Service, $timeout Service, $interval service* | *replaceOne(), findAndModify() Update operation :Examples* |
| | SLO-2 | *Java script Operators-Arithmetic and Relational* | *Nested Function* | *Controller Methods* | *Creating own services* | *findOneAndDelete() Delete operation Examples* |
| S-7 | SLO-1 | *Logical, Bitwise* | *Introduction Web Stack* | *Two – way Data binding :* | *Angular JS $http and methods, Angular JS $http and Properties* | *Operation on Mongodb Data: Projection, Limiting Records Sorting Records* |
| | SLO-2 | *Assignment and Special operators* | *LAMP, LEMP,MEAN* | *i)Creating Angular Application using ng-app* | *Displaying Data in a Table, Displaying with CSS Style* | *Indexes in Mongodb, default _id index, Creating and Index createIndex method* |
| S-8 | SLO-1 | *Java Script Datatypes- Numeric* | *Angular Environment set up – windows* | *ii)Adding a ng-model* | *Angular JS Select Box* | *Single Field, Compound, Multikey,* |
| | SLO-2 | *Java Script Datatypes- Non Numeric* | *Angular JS Framework, Angular JS with HTML* | *iii)Adding a ng-bind or Angular Js expression* | *Data Source as Object* | *Geospatial,text Index, Hashed Index* |
| S 9-10 | SLO-1 | *Laboratory 2 : Java Script Operators and Conditions* | *Laboratory 5:Angular Js directives* | *Laboratory 8: data binding* | *Laboratory 11 : location service and timeout service* | *Laboratory 14: Working with CURD operations Update and Delete* |
| | SLO-2 | | | | | |
| S-11 | SLO-1 | *Conditional Statements* | *Angular directives* | *Creating Angular JS Application* | *MongoDB Datatypes: i)Integer ii)Boolean iii)Double iv)String v)Arrays vi)Object vii)Null viii)Regular expression ix)Timestamp x)Date xi)Object ID* | *Properties of Index i)Unique Indexes ii)Partial Indexes iii)Sparse Indexes iv)TTL Indexes* |
| | SLO-2 | *If,If..else Statements, If...else if... statement* | *Builtin directives- ng-app, ng-init* | *Creating a module* | *Installing and Working with MongoDB interfaces: i)Mongo Shell, ii)Mongo Compass* | *Aggregation in Mongodb: i)aggregate() method Aggregate expressions: i) $sum ii) $avg iii) $min iv) $max* |
| S-12 | SLO-1 | *JavaScript Switch Statement* | *ng-model, ng-bind, ng-controller* | *Adding a controller* | *Introduction to entities of MongoDB: i)Databases i)Collections and iii)Documents* | *v) $push vi) $addToSet vii) $first viii) $last* |
| | SLO-2 | *Iteration Statement* | *ng-repeat, ng-readonly, ng-disabled, ng-if* | *Adding a Directive* | *Database: i)createDatabase()method with example* | *MongoDB Backup: Export/Import data backup using shell i)mongodump ii)mongorestore* |
| S-13 | SLO-1 | *For Loop* | *Create new directives* | *Modules in Files* | *ii)dropDatabase() method with example* | *MongoDB Backup: Export/Import data backup using Mongo Compass* |
| | SLO-2 | *Do..While Loop, While Loop* | *Restrictions* | *Controllers in Files* | *Collections: i)createCollection() method with Example ii)dropCollection() method with example* | *Monitoring Deployment using Mongodb: mongostat, mongotop, serverStatus, dbStats, collStats* |
| S 14-15 | SLO-1 | *Laboratory 3 : Looping Statements* | *Laboratory 6: Manipulating strings and numbers* | *Laboratory 9: Data binding: controllers and external files* | *Laboratory 12: creating a database in MongoDB* | *Laboratory 15: i)Creating different types of indexes ii)Aggregate data using different Aggregate expressions iii) Perform Mongodb data Export and Import using shell as well as mongo compass. iv)Working with mongo deployment commands* |
| | SLO-2 | | | | | |

| **Learning Resources** | 1. Ken Williamson (2015), "Learning AngularJS: A Guide to AngularJS Development", O'REILLY | 1. URL: https://docs.AngularJS.org/api<br>2. URL: https://docs.mongodb.com/manual/tutorial/ |
|---|---|---|

| Learning Assessment | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Bloom's Level of Thinking | Continuous Learning Assessment (100% weightage) | | | | | | | |
| | | CLA – 1 (20%) | | CLA – 2 (20%) | | CLA – 3 (30%) | | CLA – 4# (30%) | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% |
| | Understand | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | |
| Level 3 | Evaluate | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Create | | | | | | | | |
| | Total | 100% | | 100% | | 100% | | 100 % | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

| Course Designers | | |
|---|---|---|
| Experts from Industry | Experts from Higher Technical Institutions | Internal Experts |
| Mr. S. Karthik, Assistant Consultant, Tata Consultancy Services | Dr.S.Sasikala, Associate Professor and Head, Dept. of Computer Science, University of Madras | Dr. SweetyBakyarani. E |
| | | Dr. Sabeen |

| Course Code | PCD21AE3T | Course Name | EMPLOYABILITY SKILLS | Course Category | A | Ability Enhancement Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 1 | 0 | 0 | 1 |

| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Career Development Centre | Data Book / Codes/Standards | | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: | Learning | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) |
| CLR-1: | *develop contextual approach to acquire new vocabulary* | | | |
| CLR-2: | *establish clear relationship between words* | | | |
| CLR-3: | *identify problems* | | | |
| CLR-4: | *learn the fundamental skills to solve problems* | | | |
| CLR-5: | *acquire experience of attending group discussion and personal interview* | | | |
| CLR-6: | *equipping students with necessary employability skills* | | | |

| Course Learning Outcomes (CLO): | At the end of this course, learners will be able to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Disciplinary Knowledge | Critical Thinking | Problem Solving | Analytical Reasoning | Research Skills | Team Work | Scientific Reasoning | Reflective Thinking | Self-Directed Learning | Multicultural Competence | ICT Skills | Life Long Learning | PSO - 1 | PSO - 2 | PSO - 3 |
| CLO-1: | *determine the accurate meanings of words* | 2 | 80 | 75 | H | H | H | H | H | | | | | | | | | | |
| CLO-2: | *recognise parallel relationship between words* | 2 | 80 | 70 | H | H | H | H | H | | | | | | | | | | |
| CLO-3: | *learn to solve problems* | 2 | 75 | 70 | H | H | H | H | H | | | | | | | | | | |
| CLO-4: | *understand and applies problem solving skills learned.* | 2 | 80 | 75 | H | H | H | H | H | | | | | | | | | | |
| CLO-5: | *inculcate professional communication through Interviews & Group Discussions* | 2 | 80 | 70 | H | H | H | H | H | | | | | | | | | | |
| CLO-6: | *Acquire necessary skills for successful career* | 2 | 80 | 75 | H | H | H | H | H | | | | | | | | | | |

| Duration (hour) | | 3 | 3 | 3 | 3 | 3 |
|---|---|---|---|---|---|---|
| S-1 | SLO-1 | *Time & work* | *Time, speed, distance* | *Permutation and combination* | *Probability* | *Geometry and Mensuration* |
| | SLO-2 | *Solving problems* | *Solving problems* | *Solving problems* | *Solving problems* | *Solving problems* |
| S-2 | SLO-1 | *Perspective on Issues* | *Critical Reasoning* | *Synonyms* | *Antonyms* | *Word Analogy* |
| | SLO-2 | *Perspective on Issues* | *Critical Reasoning* | *Synonyms* | *Antonyms* | *Word Analogy* |
| S-3 | SLO-1 | *Resume preparation* | *Group Discussion* | *Mock GD* | *Interview Techniques* | *Mock PI* |
| | SLO-2 | *Resume preparation* | *Group Discussion* | *Mock GD* | *Interview Techniques* | *Mock PI* |

| Learning Resources | |
|---|---|
| 1. | Quantitative aptitude by Dinesh Khattar |
| 2. | Ramachandran and Karthik, From Campus to Corporate, India, PEARSON Publication, 2016. |
| 3. | Verbal Advantage – Ten Easy Steps to a Powerful Vocabulary – Charles Harrington Elster |
| 4. | Barron's GRE |

| Learning Assessment | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Bloom's Level of Thinking | Continuous Learning Assessment (50% weightage) | | | | | | | | Final Examination (50% weightage) | |
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4 (10%)# | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember<br>Understand | 30 % | - | 30 % | - | 30 % | - | 30 % | - | 30 % | - |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 2 | Apply<br>Analyze | 40 % | - | 40 % | - | 40 % | - | 40 % | - | 40 % | - |
| Level 3 | Evaluate<br>Create | 30 % | - | 30 % | - | 30 % | - | 30 % | - | 30 % | - |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100 % | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

| **Course Designers** | | |
|---|---|---|
| Experts from Industry | Internal Experts | |
| **1.Mr. Ajay Zenne, Career Launcher,**ajay.z@careerlauncher.com | **1. Dr.P.Madhusoodhanan, SRMIST** | 2. Dr. A Clement, SRMIST |
| | **3. Dr.M.Snehalatha, SRMIST** | 4. Dr.Jayapragash J, SRMIST |
| **2.**Mr.Pratap Iyer, Study Abroad Mentors, Mumbai,**pratap.iyer30@gmail.com** | 5. Mr.Harinarayana Rao, **SRMIST** | 6. Mr. P Priyanand, SRMIST |
| | 7. Mrs.KavithaSrisarann, SRMIST | |

**Semester - IV**

| Course Code | PCS21E41L | Course Name | PROJECT WORK | Course Category | P | Project Work | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 0 | 0 | 24 | 12 |

| Pre-requisite Courses | Nil | Co-requisiteCourses | Nil | ProgressiveCourses | Nil |
|---|---|---|---|---|---|
| Course Offering Department | Computer Science | Data Book / Codes/Standards | | As required for the project work | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to: | Learning | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) |
| CLR-1 : | *CLR-1 : To prepare the student to gain major design and or research experience as applicable to the profession* | | | |
| CLR-2 : | *Apply knowledge and skills acquired through earlier course work in the chosen project* | | | |
| CLR-3 : | *Make conversant with the codes, standards , application software and equipment* | | | |
| CLR-4 : | *Carry out the projects within multiple design constraints* | | | |
| CLR-5 : | *Incorporate multidisciplinary components* | | | |
| CLR-6 : | *Acquire the skills of comprehensive report writing* | | | |

| Course Learning Outcomes (CLO): | At the end of this course, learners will be able to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Fundamental Knowledge | Application of Concepts | Link with Related Disciplines | Procedural Knowledge | Skills in Specialization | Ability to Utilize Knowledge | Skills in Modeling | Analyze, Interpret Data | Investigative Skills | Problem Solving Skills | Communication Skills | Analytical Skills | PSO 1 | PSO 2 | PSO 3 |
| CLO-1 : | *Design a system* | 3 | 80 | 70 | L | H | - | H | L | - | - | - | | | | | | - | - |
| CLO-2 : | *Process or gain research insight into a defined problem* | 3 | 85 | 75 | M | H | L | M | L | - | - | - | | | | | | - | - |
| CLO-3 : | *Solution to the problem as would be encountered in professional manner* | 3 | 75 | 70 | M | H | M | H | L | - | - | - | | | | | | - | - |
| CLO-4 : | *Problem solving - its impacton global, economic, environmental and social context.* | 3 | 85 | 80 | M | H | M | H | L | - | - | - | | | | | | - | - |
| CLO-5 : | *Practice software project phases* | 3 | 85 | 75 | H | H | M | H | L | - | - | - | | | | | | - | - |
| CLO-6 : | *Implementation* | 3 | 80 | 70 | L | H | - | H | L | - | - | - | | | | | | - | - |

| Assessment Component | Expected outcome | Type | Evaluators | Criteria or basis | Marks |
|---|---|---|---|---|---|
| Review – 0 Internship | Internship letter Submission Proposed Project title to be described. Abstract of the project. | Internal | Supervisor / Guide & Project Coordinator | Feasibility Study of the project | 5 |
| Review – I Project Proposal | A short presentation about the Problem statement Literature Survey System architecture Design Specifications | Internal | Supervisor/Guide | Clarity of the idea, Preliminary work done. | 10 |
| Review – II | Presentation on Techniques, Model/ Algorithm, Modules, coding Prototype of the project | Internal | Supervisor/Guide | Clarity of idea, Presentation | 10 |
| Review – III | Final presentation, Demonstration of Project. | Internal | Supervisor/Guide | Technical demonstration, Presentation | 10 |
| Report Submission | Submission of final project report | Internal | Project Coordinator | Regularity, Originality, Systematic progress | 15 |
| Project Report | Evaluation of Project Report | External | Examiner(s)/ Reviewer(s) | Presentation, Handling Q&A | 20 |
| Viva – Voce | Final Presentation | External | | | 30 |

The assessment method for the project work consists of in-semester and end semester evaluations as detailed below:

| | Continuous Learning Assessment (50% weightage) | | | | | Final Evaluation (50% weightage) | |
|---|---|---|---|---|---|---|---|
| | Review - 0 | Review – 1 | Review – 2 | Review – 3 | Report Submission | Project Report | Viva-Voce* |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Project Work / Internship | 5% | 10% | 10% | 10% | 15% | 20 % | 30 % |

*Student has to be present for the viva voce for assessment. Otherwise it will be treated as non-appearance for the examination with final grade as 'Ab'