# Er. PERUMAL MANIMEKALAI COLLEGE OF ENGINEERING

(An Autonomous Institution–Affiliated to Anna University, Chennai)

**Koneripalli, Hosur – 635117.**

PMC
T E C H
INSPIRE TO INNOVATE

## ACADEMIC REGULATIONS 2023 (R23)
## Curriculum and Syllabi
### (Version 1)

# M.E. COMPUTER SCIENCE AND ENGINEERING

**(Applicable from 2023 -24 onwards)**

**Er. PERUMAL MANIMEKALAI**
**COLLEGE OF ENGINEERING**
PMC TECH
INSPIRE TO INNOVATE
Accredited by NAAC (A Grade) & NBA (B.E - CSE | ECE | EEE | MECH & B.TECH - IT)
AN AUTONOMOUS INSTITUTION

## REGULATIONS 2023 - AUTONOMOUS

### CHOICE BASED CREDIT SYSTEM
### M. E. COMPUTER SCIENCE AND ENGINEERING

## PROGRAM EDUCATIONAL OBJECTIVES (PEO's)

- **PEO1:** Develop proficiency as a computer science engineer with an ability to solve a wide range of computational problems and have sustainable development in industry or any other work environment.
- **PEO2:** Analyze and adapt quickly to new environments and technologies, gather new information, and work on emerging technologies to solve multidisciplinary engineering problems.
- **PEO3:** Possess the ability to think analytically and logically to understand technical problems with computational systems for a lifelong learning which leads to pursuing research.
- **PEO4:** Adopt ethical practices to collaborate with team members and team leaders to build technology with cutting-edge technical solutions for computing systems.
- **PEO5:** Strongly focus on design thinking and critical analysis to create innovative products and become entrepreneurs.

## PROGRAM OUTCOMES (PO's)

- **PO1 :** An ability to independently carry out research / investigation and development work to solve practical problems.
- **PO2:** An ability to write and present a substantial technical report/document..
- **PO3:** Students should be able to demonstrate a degree of mastery over the area of Computer Science and Engineering.
- **PO4 :** Efficiently design, build and develop system application software for distributed and centralized computing environments in varying domains and platforms.
- **PO5:** Understand the working of current Industry trends, the new hardware architectures, the software components and design solutions for real world problems by Communicating and effectively working with professionals in various engineering fields and pursue research orientation for a lifelong professional development in computer and automation arenas.
- **PO6:** Model a computer based automation system and design algorithms that explore the understanding of the tradeoffs involved in digital transformation.

M.E(CSE) 1

# PROGRAM SPECIFIC OUTCOMES (PSO's)

- **PSO1:** Apply standard practices in software development using open source programming environments to deliver a high quality and cost effective products and solutions.
- **PSO2:** Analyze and develop systems in the areas of networking, software engineering, artificial intelligence, machine learning, Internet of Things and Cloud computing to meet the industrial and societal needs.

## PEO/PO Mapping:

| PEO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PSO1 | PSO1 |
|-----|-----|-----|-----|-----|-----|-----|------|------|
| PEO1 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 |
| PEO2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 |
| PEO3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| PEO4 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| PEO5 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 |

M.E(CSE) 2

**REGULATIONS 2023 – AUTONOMOUS**

**CHOICE BASED CREDIT SYSTEM**
**M. E.COMPUTER SCIENCE AND ENGINEERING**
**CURRICULUM FOR I TO IVSEMESTERS**

**SEMESTER I**

| S.NO. | COURSE CODE | COURSE NAME | CATEGORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| THEORY | | | | | | | | |
| 1. | PPCS1FC01 | Applied Probability and Statistics for Computer Science | FC | 3 | 1 | - | 4 | 4 |
| 2. | PPCS1RM01 | Research Methodology and IPR | RM | 3 | - | - | 3 | 3 |
| 3. | PPCS1PC01 | Advanced Data Structures and Algorithms | PC | 3 | - | - | 3 | 3 |
| 4. | PPCS1PC02 | Advanced Software Engineering | PC | 3 | - | - | 3 | 3 |
| 5. | PPCS1PC03 | Database Practices | PC | 3 | - | 2 | 5 | 4 |
| 6. | PPCS1ACXX | Audit Course–I | AC | 2 | - | - | 2 | 0 |
| PRACTICALS | | | | | | | | |
| 7. | PPCS1PL01 | Advanced Data Structures and Algorithms Laboratory | PC | - | - | 4 | 4 | 2 |
| 8. | PPCS1PL02 | Advanced Software Engineering Laboratory | PC | - | - | 4 | 4 | 2 |
| | | Total | | 17 | 1 | 10 | 28 | 21 |

M·E(CSE) 3

| S.NO. | COURSE CODE | COURSE NAME | CATEGORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| THEORY | | | | | | | | |
| 1. | PPCS2PC04 | Advanced Networking Technologies | PC | 3 | - | - | 3 | 3 |
| 2. | PPCS2PC05 | Machine Learning | PC | 3 | - | - | 3 | 3 |
| 3. | PPCS2PEXX | PROFESSIONALELECTIVE-1 | PE | 3 | - | - | 3 | 3 |
| 4. | PPCS2PEXX | PROFESSIONALELECTIVE-2 | PE | 3 | - | - | 3 | 3 |
| 5. | PPCS2PEXX | PROFESSIONALELECTIVE-3 | PE | 3 | - | - | 3 | 3 |
| 6. | PPCS1ACXX | Audit Course--II | AC | 2 | - | - | 2 | 0 |
| PRACTICALS | | | | | | | | |
| 7. | PPCS2PL03 | Machine Learning Laboratory | PC | - | - | 4 | 4 | 2 |
| 8. | PPCS2PL04 | Advanced Networks Laboratory | PC | - | - | 4 | 4 | 2 |
| 9. | PPCS2PL05 | Term Paper Writing and seminar | EEC | - | - | 4 | 4 | 2 |
| | | Total | | 17 | | 12 | 29 | 21 |

## SEMESTER III

| S.NO. | COURSE CODE | COURSE NAME | CATEGORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| THEORY | | | | | | | | |
| 1. | PPCS3PC06 | Multicore Architecture and Programming | PC | 3 | - | - | 3 | 3 |
| 2. | PPCS3PEXX | PROFESSIONAL ELECTIVE-4 | PE | 3 | - | - | 3 | 3 |
| 3. | PPCS3PEXX | PROFESSIONALELECTIVE-5 | PE | 3 | - | - | 3 | 3 |
| 4. | OE | OPEN ELECTIVE | OE | 3 | - | - | 3 | 3 |
| PRACTICALS | | | | | | | | |
| 5. | PPCS3PR01 | Project Work I | PR | - | - | 12 | 12 | 6 |
| | | Total | | 12 | - | 12 | 24 | 18 |

## SEMESTER IV

| S.NO. | COURSE CODE | COURSENAME | CATEGORY | PERIODSPER WEEK | | | TOTALCONTACTPERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| 1. | PPCS3PR02 | Project Work II | PR | - | - | 24 | 24 | 12 |
| | | Total | | - | - | 24 | 24 | 12 |

**TOTAL CREDITS: 72**

## PROFESSIONAL ELECTIVES

### SEMESTER II ELECTIVE I

| S.NO. | COURSE CODE | COURSENAME | CATEGORY | PERIODS PER WEEK | | | TOTALCONTACTPERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| THEORY | | | | | | | | |
| 1. | PPCS2PE01 | HUMAN COMPUTER INTERACTION | PE | 3 | - | - | 3 | 3 |
| 2. | PPCS2PE02 | MOBILE AND PERVASIVE COMPUTING | PE | 3 | - | - | 3 | 3 |
| 3. | PPCS2PE03 | BIG DATA MINING | PE | 3 | - | - | 3 | 3 |

### SEMESTER II ELECTIVE II

| S.NO. | COURSE CODE | COURSENAME | CATEGORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| THEORY | | | | | | | | |
| 1. | PPCS2PE04 | BLOCKCHAIN TECHNOLOGIES | PE | 3 | - | - | 3 | 3 |
| 2. | PPCS2PE05 | AGILE METHODOLOGIES | PE | 3 | - | - | 3 | 3 |
| 3. | PPCS2PE06 | SOFTWARE QUALITY ASSURANCE | PE | 3 | | | 3 | 3 |

### SEMESTER II ELECTIVE III

| S.NO. | COURSE CODE | COURSENAME | CATEGORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| THEORY | | | | | | | | |
| 1. | PPCS2PE07 | INTERNET OF THINGS AND CLOUD | PE | 3 | - | - | 3 | 3 |
| 2. | PPCS2PE08 | NATURAL LANGUAGE PROCESSING | PE | 3 | - | - | 3 | 3 |
| 3. | PPCS2PE09 | DATA VISUALIZATION TECHNIQUES | PE | 3 | - | - | 3 | 3 |

N·A(CSE)b

## SEMESTER III ELECTIVE IV

| S.NO. | COURSE CODE | COURSENAME | CATEGORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| THEORY | | | | | | | | |
| 1. | PPCS3PE10 | Principles of Data Science | PE | 3 | - | - | 3 | 3 |
| 2. | PPCS3PE11 | Bioinformatics | PE | 3 | - | - | 3 | 3 |
| 3. | PPCS3PE12 | Cloud Security | PE | 3 | - | - | 3 | 3 |

## SEMESTER III ELECTIVE V

| S.NO. | COURSE CODE | COURSENAME | CATEGORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| THEORY | | | | | | | | |
| 1. | PPCS3PE13 | Image Processing | PE | 3 | - | - | 3 | 3 |
| 2. | PPCS3PE14 | Bio Inspired Computing | PE | 3 | - | - | 3 | 3 |
| 3. | PPCS3PE15 | Software Project Management | PE | 3 | - | - | 3 | 3 |

## AUDIT COURSES

| S.NO. | COURSE CODE | COURSE NAME | CATEGORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| THEORY | | | | | | | | |
| 1 | PPCS1AC01 | English for Research Paper Writing | AC | 2 | 0 | 0 | 2 | 0 |
| 2 | PPCS1AC02 | Disaster Management | AC | 2 | 0 | 0 | 2 | 0 |
| 3 | PPCS1AC03 | Constitution of India | AC | 2 | 0 | 0 | 2 | 0 |
| 4 | PPCS1AC04 | நற்றமிழ் இலக்கியம் | AC | 2 | 0 | 0 | 2 | 0 |
| | | Total | | 8 | 0 | 0 | 8 | 0 |

M.E(CSE)7

## SUMMARY

| S.NO | Subject Area | I | II | III | IV | Total Credits |
|------|--------------|-----|-----|-----|-----|---------------|
| | | Credits Per Semester | | | | |
| 1 | FC | 4 | | | | 4 |
| 2 | RM | 3 | | | | 3 |
| 3 | PC | 14 | 10 | 3 | | 27 |
| 4 | PE | | 9 | 6 | | 15 |
| 5 | OE | | | 3 | | 3 |
| 6 | EEC | | 2 | | | 2 |
| 7 | AC | | | | | 0 |
| 8 | PR | | | 6 | 12 | 18 |
| | Total | 21 | 21 | 18 | 12 | 72 |

**TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 72**

| | |
|------|-----------------------------------|
| FC | Foundation Course |
| RM | Basic Science |
| PC | Professional Core |
| PE | Professional Elective |
| OE | Open Elective |
| EEC | Employment and Enhancement Course |
| AC | Audit Course |
| PR | Project |

| S.NO. | COURSE CODE | COURSE NAME | CATEGORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| THEORY | | | | | | | | |
| 1. | PPCS1FC01 | Applied Probability and Statistics for Computer Science | FC | 3 | 1 | - | 4 | 4 |
| 2. | PPCS1RM01 | Research Methodology and IPR | RM | 3 | - | - | 3 | 3 |
| 3. | PPCS1PC01 | Advanced Data Structures and Algorithms | PC | 3 | - | - | 3 | 3 |
| 4. | PPCS1PC02 | Advanced Software Engineering | PC | 3 | - | - | 3 | 3 |
| 5. | PPCS1PC03 | Database Practices | PC | 3 | - | 2 | 5 | 4 |
| 6. | PPCS1ACXX | Audit Course–I | AC | 2 | - | - | 2 | 0 |
| PRACTICALS | | | | | | | | |
| 7. | PPCS1PL01 | Advanced Data Structures and Algorithms Laboratory | PC | - | - | 4 | 4 | 2 |
| 8. | PPCS1PL02 | Advanced Software Engineering Laboratory | PC | - | - | 4 | 4 | 2 |
| | | Total | | 17 | 1 | 10 | 28 | 21 |

M.E (CSE) 9

| PPCS1FC01 | APPLIED PROBABILITY AND STATISTICS FOR COMPUTER SCIENCE | L T P C |
|---|---|---|
| | | 3 1 0 4 |

## COURSE OBJECTIVE

- To encourage students to develop a working knowledge of the central ideas of Linear Algebra.
- To enable students to understand the concepts of Probability and Random Variables.
- To understand the basic probability concepts with respect to two dimensional random variables along with the relationship between the random variables and the significance of the central limit theorem.
- To apply the small / large sample tests through Tests of hypothesis.
- To enable the students to use the concepts of multivariate normal distribution and principal components analysis

| UNIT I: LINEAR ALGEBRA | 12 |
|---|---|

Vector spaces – norms – Inner Products –Gram-Schmidt process - Eigenvalues using QR transformations – QR factorization – generalized eigenvectors – Canonical forms – singular value decomposition and applications – least square approximations.

| UNIT II: PROBABILITY AND RANDOM VARIABLES | 12 |
|---|---|

Probability – Axioms of probability – Conditional probability – Baye's theorem – Random variables – Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson , Geometric, Uniform, Exponential and Normal distributions -Functions of One dimensional random variable.

| UNIT III: TWO DIMENSIONAL RANDOM VARIABLES | 12 |
|---|---|

Joint distributions – Marginal and conditional distributions – Functions of two-dimensional random variables – Regression curve – Correlation.

| UNIT IV: TESTING OF HYPOTHESIS | 12 |
|---|---|

Sampling distributions – Type I and Type II errors – Small and Large samples – Tests based on Normal, t, Chi square and F distributions for testing of mean ,variance.– Tests for independence of attributes and goodness of fit.

| UNIT - V: MULTIVARIATE ANALYSIS | 12 |
|---|---|

Random vectors and matrices - Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components – Population principal components – Principal components from standardized variables.

**TOTAL: 60 PERIODS**

## COURSE OUTCOMES:

At the end of course, students will be able to

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Apply the concepts of Linear Algebra to solve practical problems | Understand |
| CO2 | Apply the ideas of probability and random variables in solving engineering problems. | Apply |
| CO3 | Apply the basic concepts of one and two dimensional random variables and apply in engineering applications. | Apply |
| CO4 | Apply the concept of testing of hypothesis for small and large samples in real life problems. | Apply |
| CO5 | Develop critical thinking based on empirical evidence and the scientific approach to knowledge development. | Apply |

## CO – PO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | 2 | 2 | 2 |
| CO2 | 3 | 2 | 2 | 2 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 2 | 2 | 2 |
| CO4 | 2 | 1 | 3 | 2 | 2 | 2 |
| CO5 | 2 | 2 | 1 | 2 | 2 | 2 |

M-E(CSE)10

**TEXTBOOK:**

1. Friedberg. A.H., Insel. A.J. and Spence. L., "Linear Algebra", Prentice Hall of India, New Delhi, 5th Edition, 2022.
2. Ibe, O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, second edition Indian Reprint, 2019.

**REFERENCES:**

1. Dallas E Johnson, "Applied multivariate methods for data Analysis", Thomson and Duxbury press, Singapore, 6$^{th}$ edition, 2012.
2. Richard A. Johnson and Dean W. Wichern, "Applied multivariate statistical Analysis", Pearson Education, Fifth Edition, 6th Edition, New Delhi, 2015.
3. Bronson, R., "Matrix Operation" Schaum's outline series, Tata McGraw Hill, New York, 2011.
4. Oliver C. Ibe, "Fundamentals of Applied probability and Random Processes", Academic Press, Boston, 2014.
5. Johnson R. A. and Gupta C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson India Education, Asia, 9th Edition, New Delhi, 2017.

**WEBSITE ADDRESS**

1.https://www.acsu.buffalo.edu/~bialas/EAS305/docs/EAS305%20NOTES%202005.pdf

2.https://www.utstat.toronto.edu/mikevans/jeffrosenthal/book.pdf

3.https://www.geneseo.edu/~aguilar/public/assets/courses/233/main_notes.pdf

**NPTEL**

1. https://digimat.in/nptel/courses/video/111101115/L01.html
2. https://archive.nptel.ac.in/courses/111/104/111104032/
3. https://archive.nptel.ac.in/courses/103/106/103106120/

M.E (CSE) 11

| PPCS1RM01 | RESEARCH METHODOLOGY AND IPR | L T P C |
|---|---|---|
| | | 3 0 0 3 |

## COURSE OBJECTIVE

To understand Problem formulation, analysis and solutions.
To educate about Technical paper writing / presentation without violating professional ethics.
To Familiarize Patent drafting and filing patents skills.
To impart skills through case studies.

## UNIT I: RESEARCH PROBLEM FORMULATION                                              9

Meaning of research problem - Sources of research problem, criteria characteristics of a good research problem, errors in selecting a research problem, scope and objectives of research problem-Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, necessary instrumentations.

## UNIT II: LITERATURE REVIEW                                              9

Effective literature studies approaches, analysis, plagiarism, and research ethics.

## UNIT III: TECHNICAL WRITING / PRESENTATION                                              9

Effective technical writing, how to write a report, paper, developing a research proposal, format of research proposal, a presentation and assessment by a review committee.

## UNIT IV: INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS                                              9

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

## UNIT V: DEVELOPMENTS IN INTELLECTUAL PROPERTY RIGHTS                                              9

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System, IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

|  |  | TOTAL: 45 PERIODS |
|---|---|---|

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

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Infer the sources, criteria characteristics, scope, objectives and investigation of solutions for research problem. | Understand |
| CO2 | Ability to carry out research analysis. | Apply |
| CO3 | Ability to follow research ethics | Understand |
| CO4 | Ability to infer that today's world is controlled by Computer, Information Technology | Understand |
| CO5 | Explain the scope of IPR and filing patents after Research and Development | Apply |

M.E(CSE)12

## CO – PO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 2 | 1 | 3 | 1 | 2 | 2 |
| CO2 | 2 | 2 | 3 | 2 | 2 | 2 |
| CO3 | 2 | 1 | 1 | 1 | 2 | 2 |
| CO4 | 2 | 2 | 2 | 2 | 3 | 3 |
| CO5 | 2 | 2 | 1 | 1 | 3 | 3 |

**TEXTBOOK:**

1. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd.
2. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners",2010

**REFERNCES:**

1. C. R. Kothari, Research Methodology – Methods and Techniques, Third Ed., New Age International Publishers, New Delhi,2019.
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction", Juta, 2019.
3. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students", Juta and Company,2019.

**WEBSITE REFERENCE:**

1. https://ipindia.gov.in/
2. https://www.meity.gov.in/ipr-initiatives

**NPTEL/ SWAYAM/ MOOC REFERENCE:**

1. https://onlinecourses.nptel.ac.in/noc23_ge36
2. https://onlinecourses.nptel.ac.in/noc22_hs59

M·E(SE)13

| PPCS1PC01 | ADVANCED DATA STRUCTURES AND ALGORITHMS | L T P C |
|---|---|---|
| | | 3 0 0 3 |

**COURSE OBJECTIVE**

- To understand the usage of algorithms in computing
- To use hierarchical data structures and its operations
- To learn the usage of graphs and its applications
- To design data structures and algorithms that is appropriate for problems
- To learn about NP Completeness of problems.

**UNIT I: ROLE OF ALGORITHMS IN COMPUTING & COMPLEXITY ANALYSIS**      9

Algorithms – Algorithms as a Technology -Time and Space complexity of algorithms- Asymptotic analysis-Average and worst-case analysis-Asymptotic notation-Importance of efficient algorithms- Program performance measurement - Recurrences: The Substitution Method – The Recursion-Tree Method- Data structures and algorithms.

**UNIT II: HIERARCHICAL DATA STRUCTURES**      9

Binary Search Trees: Basics – Querying a Binary search tree – Insertion and Deletion- Splay trees - Red Black trees: Properties of Red-Black Trees – Rotations – Insertion – Deletion -B-Trees: Definition of B -trees – Basic operations on B-Trees – Deleting a key from a B-Tree-Tries - Heap – Heap Implementation - Fibonacci Heaps: structure – Mergeable-heap operations- Decreasing a key and deleting a node.

**UNIT III: GRAPHS**      9

Graphs traversals – Topological Sort –Minimum Spanning Trees: Kruskal and Prim- Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra's Algorithm; Dynamic Programming - All-Pairs Shortest Paths: Shortest Paths and Matrix Multiplication – The Floyd-Warshall Algorithm- Graph coloring.

**UNIT IV: ALGORITHM DESIGN TECHNIQUES**      9

Dynamic Programming: Matrix-Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence- Greedy Algorithms: – Elements of the Greedy Strategy- An Activity-Selection Problem - Huffman Coding.

**UNIT - V: COMPLEXITY CLASSES**      9

Polynomial/Exponential Time -Decision Problem -Types of Complexity Classes- Relationship Between P, NP, NP Hard and NP Complete-Clique Decision Problem.

| | **TOTAL: 45 PERIODS** |
|---|---|

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

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Identify suitable data structures and algorithms to solve computing problems. | Remember |
| CO2 | Implement efficient data structures and apply them to solve problems. | Apply |
| CO3 | Design algorithms using graph structure to solve real-life problems. | Apply |
| CO4 | Develop various dynamic programming algorithms. | Apply |
| CO5 | Apply suitable design strategy for problem solving. | Apply |

**CO – PO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3 | 2 | 2 | 3 | 1 | 3 |
| CO2 | 3 | 2 | 3 | 2 | 2 | 3 |
| CO3 | 3 | 2 | 3 | 1 | 1 | 2 |
| CO4 | 3 | 2 | 3 | 2 | 1 | 1 |
| CO5 | 3 | 3 | 3 | 1 | 1 | 1 |

**TEXTBOOK:**

1. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2022.

2. Robert Sedgewick and Kevin Wayne,"ALGORITHMS", Fourth Edition, Pearson Education 2022

**REFERENCES:**

1. S.Sridhar,"Design and Analysis of Algorithms", First Edition, Oxford University Press. 2020.

2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein,"Introduction to Algorithms", Third Edition, Prentice-Hall, 2019.

3. Mark Allen Weiss, Data Structures and Algorithms in C++, Fourth Edition, Pearson, 2022.

**WEBSITE REFERENCE:**

1. https://www.vlab.co.in/broad-area-computer-science-and-engineering

**NPTEL/ SWAYAM/ MOOC REFERENCE:**

. 1. https://iitbombayx.in/courses/foundation-data-structures

M·F(CSE)15

| PPCS1PC02 | ADVANCED SOFTWARE ENGINEERING | L T P C |
|---|---|---|
| | | 3 0 0 3 |

## COURSE OBJECTIVE

- To familiarize the students with memorize software engineering practice process models, Identify requirements prioritization,
- To gain knowledge of the system analysis and design concepts,
- To understand software testing approaches, Apply project management and change management.

### UNIT I: Software Engineering Modeling      9

The Evolving role of Software - The changing Nature of Software - Legacy software - A generic view of process - A layered Technology - A Process Framework - Software Development Life cycle (SDLC) Models: Waterfall Model - Prototype Model - Spiral Model - Evolutionary Development Models - Iterative Enhancement Models - Incremental Process Model - Concurrent Development Model - The Unified Process.

### UNIT II: Requirement analysis      9

Software Requirements - Functional & non-functional - Software requirements document - Requirement engineering process: Feasibility studies - Elicitation - Validation & Management - Software prototyping - Analysis and modeling.

### UNIT III: ARCHITECTURE AND DESIGN      9

Software design – Design process – Design concepts – Coupling – Cohesion – Functional independence – Design patterns – Model-view-controller – Publish-subscribe – Adapter – Command – Strategy – Observer – Proxy – Facade – Architectural styles – Layered - Client- server - Tiered - Pipe and filter.- User interface design

### UNIT IV: TESTING      9

Testing – Unit testing – Black box testing– White box testing – Integration and System testing– Regression testing – Debugging - Program analysis – Symbolic execution – Model Checking

### UNIT V: MANAGING CHANGE      9

Rationale Management- Overview of Rationale - Rationale Concepts- Rationale Activities: from Issues To Decisions-Managing Rationale- Configuration Management Concepts- Configuration Management Activities - Managing Configuration Management

**TOTAL: 45 PERIODS**

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

| COs | COURSE OUTCOMES | Cognitive level |
|---|---|---|
| CO1 | Enhance the software project management skills | Understand |
| CO2 | Comprehend the systematic methodologies involved in SE | Apply |
| CO3 | Architect and design using architectural styles and design patterns | Apply |
| CO4 | Understand software testing approaches | Understand |
| CO5 | Comprehend project management and change management | Apply |

## CO – PO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 1 | 2 | – |
| CO2 | 3 | 2 | 2 | 1 | 2 | – |
| CO3 | 3 | 3 | 3 | 3 | 1 | – |
| CO4 | 2 | 1 | 2 | 3 | 2 | – |
| CO5 | 3 | 3 | 3 | 3 | 3 | – |

M·E(CSE) 16

**TEXTBOOK:**

1. R.S. Pressman, "Software Engineering – A Practitioner"s Approach", Eighth Edition, McGraw Hill International Edition, 2015
2. Len Bass, Ingo Weber and Liming Zhu, —DevOps: A Software Architect's Perspectivel, Pearson Education, 2016
3. S. Thangasamy, "Essentials of Software Engineering", Wiley India, First Edition, 2012.
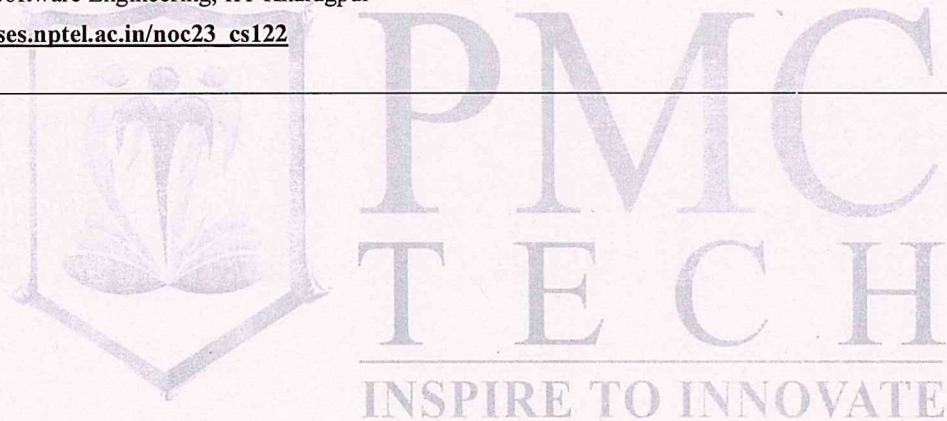
**REFERENCES:**

1. Pfleeger, and Lawrence, "Software Engineering: Theory and Practice", Second Edition, Pearson Education,2012.
2. Stephen Schach, Software Engineering 7th edition, McGraw-Hill, 2017.
3. Rajib Mall, Fundamentals of Software Engineering, 3rd edition, PHI Learning Pvt. Ltd., 2010.
4. Craig Larman, Applying UML and Patterns, 3rd edition, Pearson Education, 2011.

**WEBSITE REFERENCE:**

https://www.coursera.org/specializations/software-engineering

**NPTEL/ SWAYAM/ MOOC REFERENCE:**

1.NPTEL Course "Software Engineering, IIT Kharagpur
https://onlinecourses.nptel.ac.in/noc23_cs122

M.E(CSE)17

| PPCS1PC03 | DATABASE PRACTICES | L T P C |
|---|---|---|
| | | 3 0 2 4 |

## COURSE OBJECTIVE

- Describe the fundamental elements of relational database management systems
- Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
- Understand query processing in a distributed database system
- Understand the basics of XML and create well-formed and valid XML documents.
- Distinguish the different types of NoSQL databases
- To understand the different models involved in database security and their applications in real time world to protect the database and information associated with them.

## UNIT I: RELATIONAL DATABASE MODEL                                                          9

Entity Relationship Model – Relational Data Model – Mapping Entity Relationship Model to Relational Model – Relational Algebra – Structured Query Language, Query optimization algorithms, – Database Normalization.

## UNIT II: DISTRIBUTED DATABASES, ACTIVE DATABASES AND OPEN DATABASE CONNECTIVITY   9

Introduction to Main Memory Databases, Parallel and Distributed Databases-Distributed Database Architecture – Distributed Data Storage – Distributed Transactions – Distributed Query Processing – Distributed Transaction Management – Event Condition Action Model – Design and Implementation Issues for Active Databases – Open Database Connectivity-Optimistic Concurrency Control

## UNIT III: XML DATABASES                                                                   9

Introduction to dynamic databases, Failure classification, recovery algorithm-Structured, Semi structured, and Unstructured Data – XML Hierarchical Data Model – XML Documents – Document Type Definition – XML Schema – XML Documents and Databases – XML Querying – XPath – XQuery

## UNIT IV: NOSQL DATABASES AND BIG DATA STORAGE SYSTEMS                                      9

NoSQL – Categories of NoSQL Systems – CAP Theorem – Document-Based NoSQL Systems and MongoDB – MongoDB Data Model – MongoDB Distributed Systems Characteristics – NoSQL Key-Value Stores – DynamoDB Overview – Voldemort Key-Value Distributed Data Store – Wide Column-NoSQL Systems –NoSQL Graph Databases and Neo4j – Cypher Query Language of Neo4j – Big Data – MapReduce – Hadoop – YARN.

## UNIT V: DATABASE SECURITY                                                                 9

Database Security Issues – Discretionary Access Control Based on Granting and Revoking Privileges – Mandatory Access Control and Role-Based Access Control for Multilevel Security – SQL Injection – Statistical Database Security – Flow Control – Encryption and Public Key Infrastructures – Preserving Data Privacy – Challenges to Maintaining Database Security – Database Survivability.

**TOTAL: 45 PERIODS**

**List of Experiments:**

1. Model any given scenario into ER/EER Model using any tool ERD Plus, ER Win, Oracle SQL developer)

2. Creating applications with RDBMS Table creation with constraints, alter schema, insert values, aggregate functions, simple and complex queries with joins PLSQL-PROCEDURES, CURSORS, FUNCTIONS, TRIGGERS

3. Partition a given database based on the type of query and compares the execution speed of the query with/without parallelism.

4. Create an XML document and validate it against an XML Schema/DTD. Use XQuery to query and view the contents of the database.

5. Consider an application in which the results of football games are to be represented inXML,DTD and Xquery. For each game, we want to be able to represent the two teams involved, which one was playing at home, which players scored goals(some of which may have been penalties)and the time when each was scored, and which players were shown yellow or red cards. You might use some attributes. You can check your solutions with the online demo of the Zorba XQueryengine4.

6. To implement parallel join and parallel sort algorithms to get marks from different colleges of the

university and publish10 ranks for each discipline.

7. Create a distributed database scenario, insert values, fragment the database and query the database.

8. Consider a schema that contains the following table with the key underlined: Employee (Eno,Ename,Desg,Dno). Assume that we horizontally fragment the table as follows: Employee1(Eno, Ename, Desg, Dno), where $1 <= Dno <= 10$, Employee2(Eno, Ename, Desg,Dno), where $11 <= Dno <= 20$, Employee3 (Eno, Ename, Desg, Dno), where $21 <= Dno <= 30$. In addition, assume we have 4 sites that contain the following fragments: Site1 has Employee1, Site2 has Employee2, Site3 has Employee2 and Employee3, Site4 has Employee1. Implement at least five suitable queries on Employee fragments. Add relations to the database as per your requirements.

9. To investigation of some spatial analysis techniques using Toxic Release Inventory (www.epa.gov/triexplorer/) data for Massachusetts from the Environmental Protection Agency (EPA), which indicate the magnitude of the releases of toxic core chemicals into land, water and air at a site in the state. Note that these TRI locations were geo coded from a list of addresses provided by the EPA

10. Import the Hubway data into Neo4j and configureNeo4j.Then, answer the following questions using the Cypher Query Language:

a) List top 10 stations with most outbound trips (Show station name and number of trips) b) List top 10 stations with most inbound trips (Show station name and number of trips)

c) List top 5 routes with most trips (Show starting station name, ending station name and number of trips) d) List the hour number (for example 13 means 1pm -2pm) and number of trips which start from the station" B.U.Central"

**Total: 30 Periods**

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

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Transform the ER-model to relational tables, populate relational databases and formulate SQL queries on data. | Understand |
| CO2 | Apply methods and techniques for distributed database with the knowledge of optimization | Apply |
| CO3 | Apply methods and techniques for distributed query processing. Understand and write well-formed XML documents | Apply |
| CO4 | Infer data control, definition, and manipulation languages of the NoSQL databases | Understand |
| CO5 | Design and implement secure database systems. | Apply |

**CO – PO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 1 | 2 | 2 |
| CO2 | 3 | 1 | 2 | 1 | 1 | 1 |
| CO3 | 3 | 3 | 3 | 2 | 3 | 1 |
| CO4 | 3 | 2 | 2 | 2 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 |

**TEXTBOOK:**

1. Henry F. Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", Seventh Edition, McGraw Hill, 2019.
2. Raghu Ramakrishnan , Johannes Gehrke "Database Management Systems", Fourth Edition, McGraw Hill Education, 2015

**REFERENCES:**

1. R. Ramakrishnan, J. Gehrke, Database Management Systems, McGraw Hill, 2011
2. A. Silberschatz, Henry F. Korth, and S. Sudharshan, "Database System Concepts", 6th Ed., McGraw Hill, 2010.
3. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education 2016.
4. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006

**NPTEL/ SWAYAM/ MOOC REFERENCE:**

1. https://onlinecourses.nptel.ac.in/noc22_cs91/preview - Database Management System Prof. Partha Pratim Das, Prof. Samiran Chattopadhyay

M.E(CSE)20
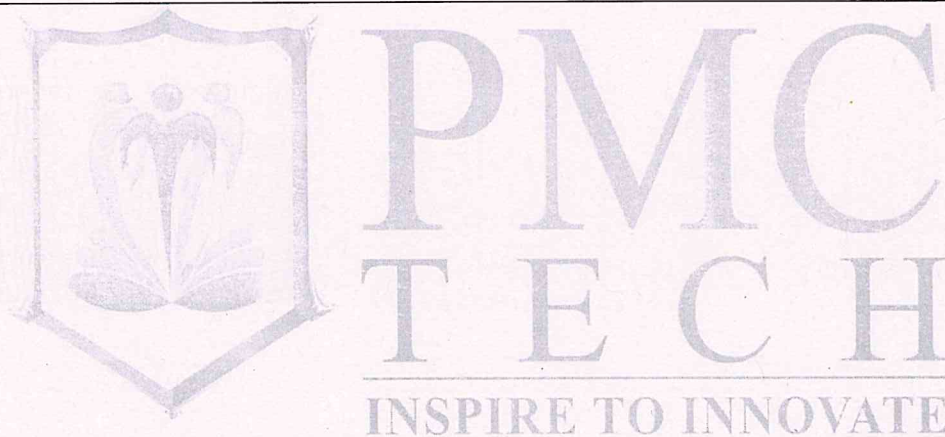
| PPCS1PL01 | ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY | L T P C |
|---|---|---|
| | | 0 0 4 2 |

## COURSE OBJECTIVE

- To acquire the knowledge of using advanced tree structures.
- To learn the usage of heap structures.
- To implement the usage of graph structures and spanning trees.
- To solve the problems such as matrix chain multiplication, activity selection and Huffman coding.
- To understand the necessary mathematical abstraction to solve problems.

## LIST OF EXPERIMENTS

1. Implementation of Merge Sort and Quick Sort

2. Implementation of a Binary Search Tree

3. Red-Black Tree Implementation

4. Splay Tree Implementation

5. Heap Implementation

6. Fibonacci Heap Implementation

7. Graph Traversals

8. Spanning Tree Implementation

9. Shortest Path Algorithms (Dijkstra's algorithm, Bellman Ford Algorithm)

10. Implement graph coloring algorithms.

11. Implementation of Matrix Chain Multiplication

12. Activity Selection and Huffman Coding Implementation

| | **TOTAL: 60 PERIODS** |
|---|---|

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

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Design and implement basic and advanced data structures. | Apply |
| CO2 | Design algorithms using graph structures. | Apply |
| CO3 | Implement efficient algorithms with minimum complexity using design techniques. | Apply |
| CO4 | Develop programs using various algorithms. | Analyze |
| CO5 | Choose appropriate data structures and algorithms to design algorithms for a specific problem. | Analyze |

## CO – PO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 2 | 3 | 1 | 1 |
| CO2 | 1 | 2 | 2 | 3 | 2 | 2 |
| CO3 | 1 | 2 | 2 | 2 | 1 | 2 |
| CO4 | 1 | 2 | 2 | 1 | 1 | 1 |
| CO5 | 2 | 3 | 3 | 1 | 1 | 1 |

M.E(CSE)21

**TEXTBOOK:**

1. Lipschutz Seymour, "Data Structures Schaum's Outlines Series", Tata McGraw Hill, 3rd Edition, 2014.

2. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2011.
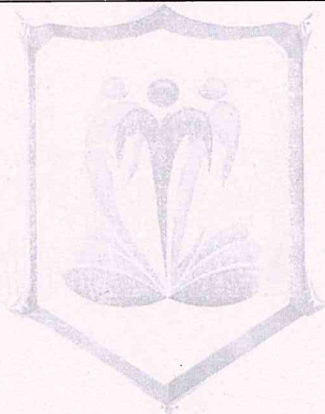
**REFERENCE :**

1. http://www.coursera.org/specializations/data-structures-algorithms

**WEBSITE REFERENCE:**

1. https://www.vlab.co.in/broad-area-computer-science-and-engineering

**NPTEL/ SWAYAM/ MOOC REFERENCE:**
1. https://iitbombayx.in/courses/foundation-data-structures
2. https://nptel.ac.in/courses/106102064

M·E(CSE)2

| PPCS1PL02 | ADVANCED SOFTWARE ENGINEERING LABORATORY | L T P C |
|---|---|---|
| | | 0  0  4  2 |

## COURSE OBJECTIVE

- The Software Engineering Lab has been developed by keeping in mind the following objectives:
- To impart state-of-the-art knowledge on Software Engineering and UML in an interactive manner through the Web.
- Present case studies to demonstrate practical applications of different concepts.
- Provide a scope to students where they can solve small, real-life problems.

## LIST OF EXPERIMENTS

1. Write a Problem Statement to define a title of the project with bounded scope of project
2. Select relevant process model to define activities and related task set for assigned project
3. Prepare broad SRS (Software Requirement Specification) for the above selected projects
4. Prepare USE Cases and Draw Use Case Diagram using modelling Tool
5. Develop the activity diagram to represent flow from one activity to another for software development
6. Develop data Designs using DFD Decision Table & ER Diagram.
7. Draw class diagram, sequence diagram, Collaboration Diagram, State Transition Diagram for the assigned     project
8. Write Test Cases to Validate requirements of assigned project from SRS Document
9. Evaluate Size of the project using function point metric for the assigned project
10. Estimate cost of the project using COCOMO and COCOCMOII for the assigned project
11. Use CPM/PERT for scheduling the assigned project
12. Use timeline Charts or Gantt Charts to track progress of the assigned project

| | TOTAL:  60 PERIODS |
|---|---|

**LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:**

**HARDWARE:**

1. Standalone desktops 30 Nos

**SOFTWARE:**

1. Rational rose/Star UML/Agro UML

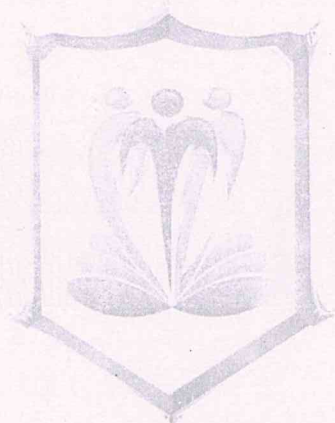**COURSE OUTCOMES**:   At the end of course, students will be able to

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Describe the basic concept of UML design | Understand |
| CO2 | Analyse the software requirements specification for a given problem | Analyze |
| CO3 | Design the DFD models | Apply |
| CO4 | Develop the various structure and behavior UML diagrams | Apply |
| CO5 | Asses the costs of a project with the help of several different assessment methods | Analyze |

MECCSE)23

**CO – PO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3 | 2 | 2 | 1 | 2 | – |
| CO2 | 3 | 2 | 2 | 1 | 2 | – |
| CO3 | 3 | 3 | 3 | 3 | 1 | – |
| CO4 | 2 | 1 | 2 | 3 | 2 | – |
| CO5 | 3 | 3 | 3 | 3 | 3 | – |

**WEBSITE REFERENCE:**

1. https://www.coursera.org/specializations/software-engineering

**SEMESTER II**

ME(CSE)24

| S.NO. | COURSE CODE | COURSE NAME | CATEGORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| THEORY | | | | | | | | |
| 1. | PPCS2PC04 | Advanced Networking Technologies | PC | 3 | - | - | 3 | 3 |
| 2. | PPCS2PC05 | Machine Learning | PC | 3 | - | - | 3 | 3 |
| 3. | PPCS2PEXX | PROFESSIONALELECTIVE-1 | PE | 3 | - | - | 3 | 3 |
| 4. | PPCS2PEXX | PROFESSIONALELECTIVE-2 | PE | 3 | - | - | 3 | 3 |
| 5. | PPCS2PEXX | PROFESSIONALELECTIVE-3 | PE | 3 | - | - | 3 | 3 |
| 6. | PPCS1ACXX | Audit Course--II | AC | 2 | - | - | 2 | 0 |
| PRACTICALS | | | | | | | | |
| 7. | PPCS2PL03 | Machine Learning Laboratory | PC | - | - | 4 | 4 | 2 |
| 8. | PPCS2PL04 | Advanced Networks Laboratory | PC | - | - | 4 | 4 | 2 |
| 9. | PPCS2PL05 | Term Paper Writing and seminar | EEC | - | - | 4 | 4 | 2 |
| | | Total | | 17 | | 12 | 29 | 21 |

MF(CSE)25

| PPCS2PC04 | ADVANCED NETWORKING TECHNOLOGIES | L T P C |
|---|---|---|
| | | 3 0 0 3 |

## COURSE OBJECTIVE

- To understand the architecture of the Internet protocols as a layered model
- To explore various technologies in the wireless domain
- To understand the fundamentals of data transmission, encoding and multiplexing
- To study about 3G and 4G cellular networks.

### UNIT I: INTRODUCTION                                                                9

Introduction to Networks - Application of Networks - Architecture Topology Switching-OSI Model - SLIP, PPP -ALOHA protocols, CSMA/CD, IEEE 802.3, 802.4, 802.5Packets, Frames, And Headers. Collision And Broadcast Domains. LAN Vs WAN Network Adapter. Hub. Switch. Router. Firewall, IP addressing.

### UNITII: NETWORK LAYER                                                              9

Network Layer Issues- Routing, Congestion control- Internetworking - Issues,. Wireless access techniques-IEEE 802.11a, 802.11g, 802.11n Bluetooth, QoS Protocol Stack – Security – Profiles

### UNIT III:  CELLULAR NETWORKS                                                       9

GSM – Mobility Management and call control – GPRS – Network Elements – Radio Resource Management –Green Wireless Networks – Physical Layer and Multiple Access – Channel Modelling for 4G –  Concepts of 5G – channel access –air interface -Cognitive Radio spectrum management – C-RAN architecture - Vehicular communications-protocol – Network slicing – MIMO,MM Wave, Introduction to 6G.Channel Structure on the Air Interface –UTRAN

### UNIT IV: TRANSPORT LAYER AND SOFTWARE DEFINED NETWORKS                             9

Transport Layer- Design issues, Connection Management, Transmission Control Protocol (TCP) User Datagram Protocol (UDP).SCTP SDN Architecture. Characteristics of Software-Defined Networking. SDN- and NFV-Related Standards. SDN Data Plane. Data Plane Functions. Data Plane Protocols. OpenFlow Logical Network Device.

### UNIT  V: APPLICATION LAYER                                                          9

Application Layer Protocol- Telnet - TFTP - FTP - SMTP - Ping Finger, Bootstrap Network Time Protocol SNMP IMAP POP3 -- HTTP.

**TOTAL: 45 PERIODS**

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

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Describe the different layers of TCP/IP protocol stack | Remember |
| CO2 | Design a network at a high-level using different networking technology. | Apply |
| CO3 | Analyze the various protocols of wireless and cellular networks. | Apply |
| CO4 | Illustrate the working principle of different protocols at different layers | Remember |
| CO5 | Apply networking concepts to real life problems | Apply |

ME(CSE)26

**CO – PO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 2 | 2 | 1 | 1 | 1 | – |
| CO2 | 3 | 2 | 1 | 1 | 2 | – |
| CO3 | 3 | 2 | 3 | 2 | 2 | – |
| CO4 | 1 | 1 | 2 | 2 | 2 | – |
| CO5 | 3 | 3 | 3 | 3 | 3 | – |

**TEXTBOOK:**

1. Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks", 6th Edition, Pearson, 2019

2. William Stallings, "Data and Computer Communications", 9th Edition, Pearson, 2011

**REFERENCES:**

1. W Richard Stevens and G. Gabrani, "TCP/IP Illustrated - Volume I, The protocols", Pearson Education, 2011

2. Eiji Oki, Roberto Rojas-Cessa, Christian Vogt, Advanced Internet Protocols, Services and Applications, John Wiley and Sons Ltd, 2012

3. Larry Peterson and B Davie, "Computer Networks: A Systems Approach", 5thedition, Morgan Kauffman, 2011

4. Paul Goransson, C. Black, "Software Defined Networks: A Comprehensive Approach", Morgan Kauffman, 2014.

5. Saad Z. Asif "5G Mobile Communications Concepts and Technologies" CRC press – 2019

**WEBSITE REFERENCE:**

1. https://en.wikipedia.org/wiki/Cellular_networkhttps://ipindia.gov.in/

2. https://www.geeksforgeeks.org/transport-layer-responsibilities/

**NPTEL/ SWAYAM/ MOOC REFERENCE:**

1. NPTEL: Application Layer Services (HTTP, FTP, Email, DNS)

2. NPTEL: TCP/IP Protocol Stack – Basic Overview

3. SWAYAM : Online course - Network Layer Primitives – IP Addressing

| PPCS2PC05 | MACHINE LEARNING | L T P C |
|---|---|---|
| | | 3 0 0 3 |

## COURSE OBJECTIVE

- To have a basic knowledge of the concepts and techniques of machine learning.
- To explore the different supervised learning techniques including unsupervised learning and reinforcement learning.
- To learn the role of neural networks and deep learning for machine learning.
- To learn the basis of machine learning with python and H2O library.

### UNIT I: INTRODUCTION      9

**Machine Learning**: History – Applications; Types of machine learning – Design of a learning system – Perspectives and issues in machine learning; **Basic statistics**: Variance and Covariance – Bias Variance tradeoff – Curse of dimensionality –Conditional Probability – Naive Bayes Classifier; Testing ML algorithms.

### UNIT II: SUPERVISED LEARNING      9

**Regression:** Introduction – Linear Regression – Least Squares – Under fitting and Overfitting — Cross-Validation – Lasso Regression – Logistic Regression; **Classification:** Linear and Non-linear models – Support Vector Machines – Kernel Methods; K-Nearest Neighbours; Learning with Trees: constructing Decision Tree using ID3 – Classification and regression trees (CART); Ensemble Methods – Bagging – Boosting – Random Forest; Evaluation of Classification Algorithms.

### UNIT III: UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING      9

**Elementary Graph Algorithms:** Representations of Graphs – Breadth-First Search – Depth-First Search – Topological Sort – Minimum Spanning Trees: Kruskal and Prim- Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra's Algorithm; Dynamic Programming - All-Pairs Shortest Paths: Shortest Paths and Matrix Multiplication – The Floyd-Warshall Algorithm.

### UNIT IV: NEURAL NETWORKS AND DEEP LEARNING      9

**Neural Networks**: Biological Motivation- Perceptron – Multi-layer Perceptron – Feed Forward
Network – Back Propagation-Activation and Loss Functions- Limitations of Machine Learning **Deep Learning:** Convolution Neural Networks – Recurrent Neural Networks – Use cases

### UNIT V: ML USING PYTHON AND H2O      9

**ML Libraries:** Introduction – H2O – Installation; Data preparation; Modelling, Running model; Grid search; Integration with Scikit learn.

**TOTAL: 45 PERIODS**

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

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Explain the basic concepts of machine learning. | Understanding |
| CO2 | Analyze linear and non-linear techniques for classification problems. | Apply |
| CO3 | Apply unsupervised and reinforcement algorithms for the given problems. | Apply |
| CO4 | Choose suitable machine learning and deep learning algorithms for a given application. | Analyze |
| CO5 | Determine appropriate solutions for real world problems using H2O.ai. | Analyze |

**CO – PO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 3 | 1 | 3 |
| CO2 | 3 | 2 | 3 | 2 | 2 | 3 |
| CO3 | 3 | 2 | 3 | 1 | 1 | 2 |
| CO4 | 3 | 2 | 3 | 2 | 1 | 1 |
| CO5 | 3 | 3 | 3 | 1 | 2 | 1 |

**TEXTBOOK:**

5. Stephen Marsland, ``Machine Learning - An Algorithmic Perspective'', Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2015.

6. Francois Chollet, "Deep Learning with Python", Manning Publications, 2017.

**REFERENCES:**

1. Ethem Alpaydin, ``Introduction to Machine Learning (Adaptive Computation and Machine Learning Series)'', Fourth Edition, MIT Press, 2020.

2. Tom M. Mitchell, "Machine Learning", First edition reprint, McGraw Hill education, 2017.

3. Peter Flach, ``Machine Learning: The Art and Science of Algorithms that Make Sense of Data'', First Edition, Cambridge University Press, 2012.

4. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", O'Reilly Media; 1 edition (April 9, 2017).

5. Trevor Hastie, Robert Tibshirani, Jerome friedman, "The Elements of Statistical learning", 2nd Edition, Springer,2017.

**WEBSITE REFERENCE:**

1.https://www.wolframalpha.com/ .

2. https://www.vlab.co.in/broad-area-computer-science-and-engineering

3. https://h2o.ai/

**NPTEL/ SWAYAM/ MOOC REFERENCE:**

1. NPTEL: Introduction To Machine Learning, By Prof. Balaraman Ravindran, IIT Madras

2. NPTEL: Deep Learning, By Prof. Sudarshan Iyengar, Prof. Padmavati, IIT Ropar.

3. NPTEL: Machine Learning And Deep Learning - Fundamentals And Applications, By Prof. M. K. Bhuyan, IIT Guwahati.

4. COURSERA: Practical Machine Learning on H2O, Darren Cook

ME(CSE)29

| PPCS2PL03 | MACHINE LEARNING LABORATORY | L T P C |
|---|---|---|
| | | 0 0 4 2 |

**COURSE OBJECTIVE**

- To understand and implement machine learning algorithms.
- To select suitable ML algorithms for a given problem and analyze its performance.
- To learn the emerging technologies for implementing ML algorithms

1. Implement a Linear Regression with (https://www.kaggle.com/harrywang/housing). Experiment with different features in building a model. Tune the model's hyperparameters.
2. Implement a binary classification model. That is, answers a binary question such as "Are houses in this neighborhood above a certain price?"(use data from exercise 1). Modify the classification threshold and determine how that modification influences the model. Experiment with different classification metrics to determine your model's effectiveness.
3. Classification with Nearest Neighbors. In this question, you will use the scikit-learn's KNN classifier to classify real vs. fake news headlines. The aim of this question is for you to read the scikit-learn API and get comfortable with training/validation splits. Use California Housing Dataset.
4. In this exercise, you'll experiment with validation sets and test sets using the dataset. Split a training set into a smaller training set and a validation set. Analyze deltas between training set and validation set results. Test the trained model with a test set to determine whether your trained model is overfitting. Detect and fix a common training problem.
5. Implement the k-means algorithm using https://archive.ics.uci.edu/ml/datasets/Codon+usage dataset
6. Implement the Naïve Bayes Classifier using https://archive.ics.uci.edu/ml/datasets/Gait+Classification dataset.
7. Implement Convolutional Neural Network.
8. Implement ML algorithms using H2O.ai.
9. Project - (in Pairs) Your project must implement one or more machine learning algorithms and apply them to some data.
   a. Your project may be a comparison of several existing algorithms, or it may propose a new algorithm in which case you still must compare it to at least one other approach.
   b. You can either pick a project of your own design, or you can choose from the set of pre-defined projects.
   c. You are free to use any third-party ideas or code that you wish as long as it is publicly available.
   d. You must properly provide references to any work that is not your own in the write-up.
   e. Project proposal You must turn in a brief project proposal. Your project proposal should describe the idea behind your project. You should also briefly describe software you will need to write, and papers (2-3) you plan to read.

List of Projects (datasets available)
1. Sentiment Analysis of Product Reviews
2. Stock Prediction
3. Sales Forecasting
4. Music Recommendation
5. Handwriting Digit Classification
6. Fake News Detection
7. Sports Prediction
8. Object Detection
9. Disease Prediction

| | TOTAL: 60 PERIODS |
|---|---|

**LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:**
**HARDWARE:**
   1. Standalone desktops 30 Nos
Intel Core i7 CPU, with minimum 16GB RAM

ME(CSE)30

**SOFTWARE:**
- Python 3.x
- Jupyter Lab
- Scientific Computing Libraries: Numpy, Scipy, MatplotLib, Pandas
- Machine Learning Libraries: Scikit-Learning
- Deep Learning Libraries: Pytorch 1.0, Tensorflow 2.0
- Cloud for application deployment and testing: Google Colab, autoML, Azure, H2O.AI, AWS

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

| COs | Course Outcomes | Cognitive level |
|-----|-----------------|-----------------|
| CO1 | Design and implement linear regression model. | Apply |
| CO2 | Implement supervised learning algorithms | Apply |
| CO3 | Apply unsupervised learning algorithms. | Apply |
| CO4 | Implement deep learning algorithms. | Apply |
| CO5 | Apply H2O.ai library to develop an application | Create |

**CO-PO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 1 | 2 | 2 | 1 | 1 | 1 |
| CO2 | 1 | 2 | 2 | 2 | 2 | 3 |
| CO3 | 1 | 2 | 2 | 1 | 2 | 1 |
| CO4 | 1 | 2 | 2 | 2 | 1 | 1 |
| CO5 | 2 | 3 | 3 | 1 | 1 | 1 |

**TEXTBOOK:**

1. Aurélien Géron , Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools , and Techniques to Build Intelligent Systems 2nd Edition, o'reilly, 2017.
2. Pasha Stetsenko, "Machine Learning with Python and H2O", Published by H2O.ai, Inc., 2017.

**REFERENCE:**

1. Francois Chollet, "Deep Learning with Python", Manning Publications, 2017
2. Shai Shalev-Shwartz and Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, 2015.

ME(CSE)31

| PPCS2PL04 | ADVANCED NETWORK TECHNOLOGY LAB | L T P C |
|-----------|--------------------------------|---------|
|           |                                | 0 0 4 2 |

## COURSE OBJECTIVE

- To introduce the computer network concepts and provide skills required to trouble shoot the network devices.
- To describe the basic knowledge of VLAN.
- To develop the knowledge for application of software defined networks

## PRACTICAL EXERCISES:

1. Hardware Demo(Demo session of all networking hardware and Functionalities) OS Commands(Network configuration commands )

2. Write a HTTP web client program to download a web page using TCP sockets.

3. Applications using TCP sockets like: a) Echo client and echo server b) Chat

4. Network Packet Analysis using Wireshark

   i. Packet Capture Using Wire shark

   ii. Starting Wire shark

   iii. Viewing Captured Traffic

   iv. Analysis and Statistics & Filters.

5. Use a tool like Wireshark to capture packets and examine the packets

6. Write a code simulating ARP /RARP protocols.

7. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.

8. Study of TCP/UDP performance using Simulation tool.

9. Simulation of Distance Vector/ Link State Routing algorithm.

10. Simulation of an error correction code (like CRC)

**TOTAL: 60 PERIODS**

## LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:
### HARDWARE:

1. Standalone desktops 30 Nos

### SOFTWARE:

1. C / C++ / Java / Python / Equivalent Compiler 30
2. Network simulator like NS2/Glomosim/OPNET/ Packet Tracer / Equivalen

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

| COs | Course Outcomes | Cognitive level |
|-----|-----------------|-----------------|
| CO1 | Understand the types of network cables and practical implementation of cross wired and straight through cable. | Understanding |
| CO2 | Design and implementation of VLAN. | Analyze |
| CO3 | Understand the basics of how data flows from one node to another. | Apply |
| CO4 | Analyze routing algorithms. | Apply |
| CO5 | Design and develop software defined networks | Analyze |

ME(CSE)32

**CO – PO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-----|-----|-----|-----|-----|-----|
| CO1 | 2 | 2 | 3 | 2 | 3 |
| CO2 | 2 | 2 | 3 | 2 | 3 |
| CO3 | 2 | 2 | 2 | 2 | 3 |
| CO4 | 2 | 2 | 2 | 2 | 3 |
| CO5 | 2 | 2 | 3 | 3 | 3 |

**TEXTBOOK:**

1.Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks", 6th Edition, Pearson, 2014

2. William Stallings, "Data and Computer Communications", 9th Edition, Pearson, 2011

**REFERENCES:**

1.W Richard Stevens and G. Gabrani, "TCP/IP Illustrated - Volume I, The protocols", Pearson Education, 2012

2. Eiji Oki, Roberto Rojas-Cessa, Christian Vogt, Advanced Internet Protocols, Services and Applications, John Wiley and Sons Ltd, 2012

3.Larry Peterson and B Davie, "Computer Networks: A Systems Approach", 5thedition, Morgan Kauffman, 2011

4. Paul Goransson, C. Black, "Software Defined Networks: A Comprehensive Approach", Morgan Kauffman, 2014.

5.Saad Z. Asif "5G Mobile Communications Concepts and Technologies" CRC press – 2019

**WEBSITE REFERENCE:**

1. https://www.geeksforgeeks.org/transport-layer-responsibilities

2. https://www.vlab.co.in/broad-area-computer-science-and-engineering

**NPTEL/ SWAYAM/ MOOC REFERENCE:**

1. NPTEL: Application Layer Services (HTTP, FTP, Email, DNS)

2. NPTEL:  TCP/IP Protocol Stack – Basic Overview

3. SWAYAM : Online course - Network Layer Primitives – IP Addressing,

ME(CSE) 33

| PPCS2PL05 | TERM PAPER WRITING AND SEMINAR | L T P C |
|---|---|---|
| | | 0 0 4 2 |

## COURSE OBJECTIVE

- To understand and implement machine learning algorithms.
- To select suitable ML algorithms for a given problem and analyze its performance.
- To learn the emerging technologies for implementing ML algorithms

1. Selecting a subject, narrowing the subject into a topic
2. Stating an objective.
3. Collecting the relevant bibliography (atleast 15 journal papers)
4. Preparing a working outline.
5. Studying the papers and understanding the authors contributions and critically analyzing each paper.
6. Preparing a working outline
7. Linking the papers and preparing a draft of the paper.
8. Preparing conclusions based on the reading of all the papers.
9. Writing the Final Paper and giving final Presentation
Please keep a file where the work carried out by you is maintained. Activities to be carried out

| Activity | Instructions | Submission week | Evaluation |
|---|---|---|---|
| Selection of area of interest and Topic Stating an Objective | You are requested to select an area of interest, topic and state an objective | 2nd week | 3 % Based on clarity of thought, current relevance and clarity in writing |
| Collecting Information about your area &topic | List1 Special Interest Groups or professional society List2journals List2conferences,symposiaorworkshops List1thesistitle List3webpresences(mailing lists ,forums ,news sites) List 3 authors who publish regularly in your area Attach a call for papers(CFP) from your area. | 3rd week | 3% ( the selected information must be are a specific and of international and national standard) |
| Collection of Journal papers in the topic in the context of the objective – collect 20 & then filter | You have to provide a complete list of references you will be using- Based on your objective -Search various digital libraries and Google Scholar When picking papers to read – try to: Pick papers that are related to each other in some ways and/or that are in the same field so that you can write a meaningful survey out of them, Favor papers from well-known journals and conferences, Favour "first" or" foundational "papers in the field (as indicated in other people's survey paper), Favour more recent papers, Pick a recent survey of the field so you can quickly gain an overview, Find relationships with respect toeachotherandtoyourtopicarea(classificationscheme/categorization) Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered | 4th week | 6% ( the list of standard papers and reason for selection) |
| Reading and notes for first 5 papers | Reading Paper Process For each paper form a Table answering the following questions: What is the main topic of the | 5th week | 8% ( the table given should indicate your understanding of the |

ME(CSE)34

| | | | |
|---|---|---|---|
| | article?<br>What was/were the main issue(s) the author said they want to discuss?<br>Why did the author claim it was important?<br>How does the work build on other's work, in the author's opinion?<br>What simplifying assumptions does the author claim to be making?<br>What did the author do?<br>How did the author claim they were going to evaluate their work and compare it to others?<br>What did the author say were the limitations of the research?<br>What did the author say were the important directions for future research? Conclude with limitations/issues not addressed by the paper (from the perspective of your survey) | | paper and the evaluation is based on your conclusions about each paper) |
| Reading and notes for next 5 papers | Repeat Reading Paper Process | 6th week | 8%<br>( the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper) |
| Reading and notes for final 5 papers | Repeat Reading Paper Process | 7th week | 8%<br>( the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper) |
| Draft outline 1 and Linking papers | Prepare a draft Outline, your survey goals, along with a classification /categorization diagram | 8th week | 8%<br>( this component will be evaluated based on the linking and classification among the papers) |
| Abstract | Prepare a draft abstract and give a presentation | 9th week | 6%<br>(Clarity, purpose and conclusion)<br>6% Presentation & Viva Voce |
| Introduction Background | Write an introduction and background sections | 10th week | 5%( clarity) |
| Sections of the paper | Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey | 11thweek | 10%<br>(this component will be evaluated based on the linking and classification among the papers) |

ME(CSE)34

| | | | | |
|---|---|---|---|---|
| Your conclusions | Write your conclusions and future work | 12th week | 5% ( conclusions – clarity and your ideas) |
| Final Draft | Complete the final draft of your paper | 13th week | 10% (formatting, English, Clarity and linking)<br>4% Plagiarism Check Report |
| Seminar | A brief 15 slides on your paper | 14th & 15th week | 10%<br>(based on presentation and Viva-voce) |

**TOTAL: 60 PERIODS**

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

Cognitive level

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Demonstrate writing meaningful sentences and coherent paragraphs | Apply |
| CO2 | Show conciseness, clarity and avoid redundancy in writing | Apply |
| CO3 | Summarize, evaluate literature, and write methodology, results and conclusion | Apply |
| CO4 | Describe how to develop title, write abstract and introduction | Apply |
| CO5 | Apply correct style of referencing and use punctuation appropriately | Create |

**CO-PO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 2 | 1 | 1 | 1 |
| CO2 | 1 | 2 | 2 | 2 | 2 | 3 |
| CO3 | 1 | 2 | 2 | 1 | 2 | 1 |
| CO4 | 1 | 2 | 2 | 2 | 1 | 1 |
| CO5 | 2 | 3 | 3 | 1 | 1 | 1 |

**REFERENCE:**

1. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg, London, 2011.
2. Day R. How to Write and Publish a Scientific Paper, Cambridge University Press, 2006.
3. Goldbort R. Writing for Science, Yale University Press, 2006.
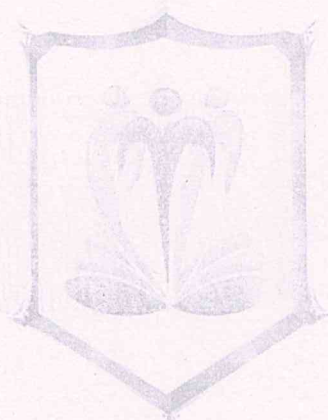4. Highman N. Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book, 1998

ME(CSE)35

**SEMESTER III**

| S.NO. | COURSE CODE | COURSE NAME | CATEGORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| THEORY | | | | | | | | |
| 1. | PPCS3PC06 | Multicore Architecture and Programming | PC | 3 | - | - | 3 | 3 |
| 2. | PPCS3PEXX | PROFESSIONAL ELECTIVE-4 | PE | 3 | - | - | 3 | 3 |
| 3. | PPCS3PEXX | PROFESSIONALELECTIVE-5 | PE | 3 | - | - | 3 | 3 |
| 4. | OE | OPEN ELECTIVE | OE | 3 | - | - | 3 | 3 |
| PRACTICALS | | | | | | | | |
| 5. | PPCS3PR01 | Project Work I | PR | - | - | 12 | 12 | 6 |
| | | Total | | 12 | - | 12 | 24 | 18 |

ME(CSE)36

| PPCS3PC06 | MULTICORE ARCHITECTURE AND PROGRAMMING | L T P C |
|-----------|-----------------------------------------|---------|
|           |                                         | 3 0 0 3 |

### UNITI: MULTI-CORE PROCESSORS — 9

Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks – Symmetric and Distributed Shared Memory Architectures – Cache coherence – Performance Issues – Parallel program design.

### UNITII: PARALLEL PROGRAM CHALLENGES — 9

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).

### UNITIII: SHARED MEMORY PROGRAMMING WITH OPENMP — 9

Open MP Execution Model – Memory Model – Open MP Directives – Work-sharing Constructs – Library functions – Handling Data and Functional Parallelism – Handling Loops – Performance Considerations

### UNITIV: DISTRIBUTED MEMORY PROGRAMMING WITH MPI — 9

MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI

### UNIT-V: PARALLEL PROGRAM DEVELOPMENT — 9

Case studies – n-Body solvers – Tree Search – Open MP and MPI implementations and comparison.

**TOTAL: 45 PERIODS**

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

| COs | Course Outcomes | Cognitive level |
|-----|-----------------|-----------------|
| CO1 | Describe multicore architectures and identify their characteristics and challenges. | Understand |
| CO2 | Identify the issues in programming Parallel Processors. | Apply |
| CO3 | Write programs using Open MP and MPI. | Apply |
| CO4 | Design parallel programming solutions to common problems. | Apply |
| CO5 | Compare and contrast programming for serial processors and programming for parallel PROCESSORS | Apply |

**CO – PO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 1 | 1 | 1 | 2 | 1 | 2 |
| CO2 | 2 | 1 | - | - | 2 | 2 |
| CO3 | 1 | - | 2 | 1 | 1 | 2 |
| CO4 | 2 | 1 | 1 | 1 | 2 | 2 |
| CO5 | 3 | 1 | 2 | 1 | 2 | 3 |

**TEXTBOOK:**

1.  Shameem  A and Jason, Multicore Programming, Intel Press, 2016.
2.  Book on "Multi-Core Architectures and Programming" Krishna Sankar Palanisami "Published Nov 6, 2016".

**REFERENCES:**

1.  Peter S. Pacheco, "An Introduction to Parallel Programming, Morgan-Kauffman/Elsevier, 2021
2.  Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris, Pearson, 2011 (unit 2)
3.  Michael J Quinn, "Parallel programming in C with MPI and OpenMP, Tata McGraw Hill,2003
4.  Victor Alessandrini, Shared Memory Application Programming, 1st Edition, Concepts and Strategies in Multicore Application Programming, Morgan Kaufmann, 2015.
5.  Yan Solihin, Fundamentals of Parallel Multicore Architecture, CRC Press, 2015.

**NPTEL/ SWAYAM/ MOOC REFERENCE:**

1.  https://archive.nptel.ac.in/courses/106/103/106103183/

ME(CSE)38

# PROFESSIONAL ELECTIVES

## SEMESTER II ELECTIVE I

| S.NO. | COURSE CODE | COURSENAME | CATEGORY | PERIODS PER WEEK | | | TOTALCONTACTPERIODS | CREDITS |
|-------|-------------|------------|----------|---|---|---|---------------------|---------|
| | | | | L | T | P | | |
| THEORY | | | | | | | | |
| 1. | PPCS2PE01 | HUMAN COMPUTER INTERACTION | PE | 3 | - | - | 3 | 3 |
| 2. | PPCS2PE02 | MOBILE AND PERVASIVE COMPUTING | PE | 3 | - | - | 3 | 3 |
| 3. | PPCS2PE03 | BIG DATA MINING | PE | 3 | - | - | 3 | 3 |

ME(CSE)39

| PPCS2PE01 | HUMAN COMPUTER INTERACTION | L T P C |
|---|---|---|
| | | 3 0 0 3 |

## COURSE OBJECTIVE

- To learn the foundations of Human Computer Interaction
- Understanding Interaction Styles and to become familiar with the design technologies for individuals and persons with disabilities.
- To understand the process of Evaluation of Interaction Design.
- To clarify the significance of task analysis for ubiquitous computing.

### UNIT I: FOUNDATIONS OF HCI                                    9

Context of Interaction –Ergonomics - Designing Interactive systems – Understanding Users cognition and cognitive frameworks, Universal Usability, Understanding and conceptualizing interaction, Guidelines, Principles and Theories. Importance of User Interface: Definition-Importance of good design-Benefits of good design -Human Performance models-A Brief history of screen design.

### UNIT II: INTERACTION STYLES                                    9

GUI: Popularity of graphics - The concept of direct manipulation - Graphical system - Characteristics - Web user - Interface Popularity - Characteristics and Principles of User Interface. Direct Navigation and Immersive environments, Fluid navigation, Expressive Human and Command Languages, , Timely user Experience, Information search, Data Visualization Design process: Human Interaction with computers - Human Interaction Speeds and Understanding Business Junctions.

### UNIT III: EVALUATION OF INTERACTION                           9

Evaluation Techniques- assessing user experience- usability testing – Heuristic evaluation and walkthroughs, analytics predictive models. Cognitive models, Socio-organizational issues and stakeholder requirements, Communication and collaboration models

### UNIT IV: MODELS AND THEORIES                                   9

Task analysis, dialog notations and design, Models of the system, Modeling rich interaction, Ubiquitous computing

### UNIT V: WEB AND MOBILE INTERACTION                            9

Hypertext, Multimedia and WWW, Designing for the web Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Use Transitions-Lookup patterns-Feedback patterns Mobile apps, Mobile navigation, content and control idioms, Multi-touch gestures, Interapp integration, Mobile web

**TOTAL: 45 PERIODS**

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

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Infer the basics of human computer interactions via usability engineering and cognitive modeling. | Understand |
| CO2 | Illustrate the basic design paradigms, complex interaction styles. | Understand |
| CO3 | Describe the models and theories for user interaction | Understand |
| CO4 | Examine the evaluation of interaction designs and implementations. | Analyze |
| CO5 | Elaborate the above issues for web and mobile applications | Understand |

ME(CSE)40

**CO – PO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 1 | - | 1 | 2 | 2 | 3 |
| CO3 | 2 | 3 | 2 | 2 | - | 1 |
| CO4 | 2 | 3 | 1 | 2 | - | 2 |
| CO5 | 2 | 2 | 3 | 3 | 3 | 3 |

**TEXTBOOKS:**

1. Ben Shneiderman, Catherine Plaisent , Maxine Cohen , Steven Jacobs, NiklisElmqviste , "Designing the User Interface :Strategies for Effective Human –Computer Interaction", Sixth Edition, Pearson Eduction,2016.

2. Alan Dix, Janet Finlay , G D Abowd and Russel Beale , "Human Computer Interaction", Pearson Education , Third Edition, 2014.

**REFERENCES :**

1. Helen Sharp Jennifer Preece Yvonne Rogers , "Interaction Design :Beyond Human Computer Interaction:", Wiley,5th Edition, 2019.

2. Alan Cooper , Robert Reimann, David Cronin,Christopher Noessel,"About Face : The Essentials of Interaction Design", 4th Edition , Wiley,2014.

3. Donald A.Norman, "Design of Everyday Things", MIT Press,2013.

4. Wilbert O Galitz, "The Essential Guide to User Interface Design", Third Edition, Wiley India   Pvt.,Ltd.,2011.

**NPTEL/ SWAYAM/ MOOC REFERENCE:**

1. NPTEL Course "Human Computer Interaction, IIT Guwahati https://onlinecourses.nptel.ac.in/noc18_cs23/preview

ME( CSE )4/

| PPCS2PE02 | MOBILE AND PERVASIVE COMPUTING | L T P C |
|---|---|---|
| | | 3 0 0 3 |

## COURSE OBJECTIVE

- To understand the basics of Mobile Computing and Personal Computing
- To learn the role of cellular networks in Mobile and Pervasive Computing
- To expose to the concept of sensor and mesh networks
- To expose to the context aware and wearable computing
- To learn to develop applications in mobile and pervasive computing environment

### UNIT I: INTRODUCTION                                                                9

Differences between Mobile Communication and Mobile Computing – Contexts and Names – Functions – Applications and Services – New Applications – Making Legacy Applications Mobile Enabled – Design Considerations – Integration of Wireless and Wired Networks – Standards Bodies – Pervasive Computing – Basics and Vision – Principles of Pervasive Computing – Categories of Pervasive Devices

### UNIT II: 3G AND 4G CELLULAR NETWORKS                                              9

Migration to 3G Networks – IMT 2000 and UMTS – UMTS Architecture – User Equipment – Radio
Network Subsystem – UTRAN – Node B – RNC functions – USIM – Protocol Stack – CS and PS
Domains – IMS Architecture – Handover – 3.5G and 3.9G a brief discussion – 4G LAN and
Cellular Networks – LTE – Control Plane – NAS and RRC – User Plane – PDCP, RLC and MAC –
WiMax IEEE 802.16d/e – WiMax Internetworking with 3GPP

### UNIT III: SENSOR AND MESH NETWORKS                                                9

Sensor Networks – Role in Pervasive Computing – In Network Processing and Data Dissemination
– Sensor Databases – Data Management in Wireless Mobile Environments – Wireless Mesh
Networks – Architecture – Mesh Routers – Mesh Clients – Routing – Cross Layer Approach –
Security Aspects of Various Layers in WMN – Applications of Sensor and Mesh networks

### UNIT IV: CONTEXT AWARE COMPUTING & WEARABLE COMPUTING                             9

Adaptability – Mechanisms for Adaptation - Functionality and Data – Transcoding – Location Aware Computing – Location Representation – Localization Techniques – Triangulation and Scene 64 Analysis – Delaunay Triangulation and Voronoi graphs – Types of Context – Role of Mobile Middleware – Adaptation and Agents – Service Discovery Middleware Health BAN-Medical and Technological Requirements-Wearable Sensors-Intra-BAN communications

### UNIT V: APPLICATION DEVELOPMENT                                                   9

Three tier architecture - Model View Controller Architecture - Memory Management – Information Access Devices – PDAs and Smart Phones – Smart Cards and Embedded Controls – J2ME – Programming for CLDC – GUI in MIDP – Application Development ON Android and iPhone

**TOTAL: 45 PERIODS**

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

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Design a basic architecture for a pervasive computing environment | Understand |
| CO2 | Design and allocate the resources on the 3G-4G wireless networks | Apply |
| CO3 | Analyze the role of sensors in Wireless networks | Apply |
| CO4 | Deploy the location and context information for application development | Analyze |
| CO5 | Develop mobile computing applications based on the paradigm of context aware computing and | Create |

ME(CSE)42

**CO – PO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3 | 2 | 2 | 2 | 1 | 2 |
| CO2 | 3 | 1 | 3 | 2 | 2 | 2 |
| CO3 | 3 | 2 | 2 | 1 | 1 | 2 |
| CO4 | 3 | 1 | 3 | 2 | 1 | 1 |
| CO5 | 3 | 2 | 2 | 1 | 2 | 1 |

**TEXTBOOK:**

1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, "Mobile Computing: Technology, Applications and Service Creation", 2nd ed, Tata McGraw Hill, 2017.

2. Reto Meier, "Professional Android 2 Application Development", Wrox Wiley,2010.

**REFERENCES:**

1. Pei Zheng and Lionel M Li, 'Smart Phone & Next Generation Mobile Computing', Morgan Kaufmann Publishers, 2016.

2. Frank Adelstein, 'Fundamentals of Mobile and Pervasive Computing', TMH, 2015

3. Jochen Burthardt et al, 'Pervasive Computing: Technology and Architecture of Mobile Internet Applications', Pearson Education, 2013

4. Feng Zhao and Leonidas Guibas, 'Wireless Sensor Networks', Morgan Kaufmann Publishers, 2014

5. Uwe Hansmaan et al, 'Principles of Mobile Computing', Springer, 2nd edition,2016

ME(CSE)43

| PPCS2PE03 | BIG DATA MINING | L T P C |
|---|---|---|
| | | 3 0 0 3 |

## COURSE OBJECTIVE

- To understand the computational approaches to Modeling, Feature Extraction
- To understand the need and application of Map Reduce
- To understand the various search algorithms applicable to Big Data
- To analyze and interpret streaming data
- To learn how to handle large data sets in main memory and learn the various clustering techniques applicable to Big Data

### UNIT I: DATA MINING AND LARGE SCALE FILES     9

Introduction to Statistical modeling – Machine Learning – Computational approaches to modeling – Summarization – Feature Extraction – Statistical Limits on Data Mining - Distributed File Systems – Map-reduce – Algorithms using Map Reduce – Efficiency of Cluster Computing Techniques.

### UNIT II : SIMILAR ITEMS     9

Nearest Neighbor Search – Shingling of Documents – Similarity preserving summaries – Locality sensitive hashing for documents – Distance Measures – Theory of Locality Sensitive Functions – LSH Families – Methods for High Degree of Similarities.

### UNIT III : MINING DATA STREAMS     9

Stream Data Model – Sampling Data in the Stream – Filtering Streams – Counting Distance Elements in a Stream – Estimating Moments – Counting Ones in Window – Decaying Windows.

### UNIT.IV: LINK ANALYSIS AND FREQUENT ITEMSETS     9

Page Rank –Efficient Computation - Topic Sensitive Page Rank – Link Spam – Market Basket Model – A-priori algorithm – Handling Larger Datasets in Main Memory – Limited Pass Algorithm – Counting Frequent Item sets.

### UNIT V: CLUSTERING     9

Introduction to Clustering Techniques – Hierarchical Clustering –Algorithms – K-Means – CURE – Clustering in Non – Euclidean Spaces – Streams and Parallelism – Case Study: Advertising on the Web – Recommendation Systems

**TOTAL: 45 PERIODS**

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

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Design algorithms by employing Map Reduce technique for solving Big Data problems | Apply |
| CO2 | Design algorithms for Big Data by deciding on the apt Features set . | Apply |
| CO3 | Design algorithms for handling petabytes of datasets | Apply |
| CO4 | Design algorithms and propose solutions for Big Data by optimizing main memory consumption. | Apply |
| CO5 | Design solutions for problems in Big Data by suggesting appropriate clustering techniques. | Apply |

### CO – PO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | 2 | 3 | 3 |
| CO2 | 2 | 1 | 2 | 1 | 2 | 2 |
| CO3 | 2 | 1 | 1 | 2 | 3 | 3 |
| CO4 | 2 | 1 | 2 | 2 | 3 | 1 |
| CO5 | 2 | 2 | 2 | 2 | 3 | 3 |

**TEXTBOOK:**

1.Jure Leskovec, AnandRajaraman, Jeffrey David Ullman,"Mining of Massive Dataset ", Cambridge University Press, 3$^{rd}$ Edition,2020.

2.Jiawei Hin, MichelineKamber , Jian Pei,"Data Mining Concepts and Techinques", Morgal Kaufman Publications,Third Edition,2012.
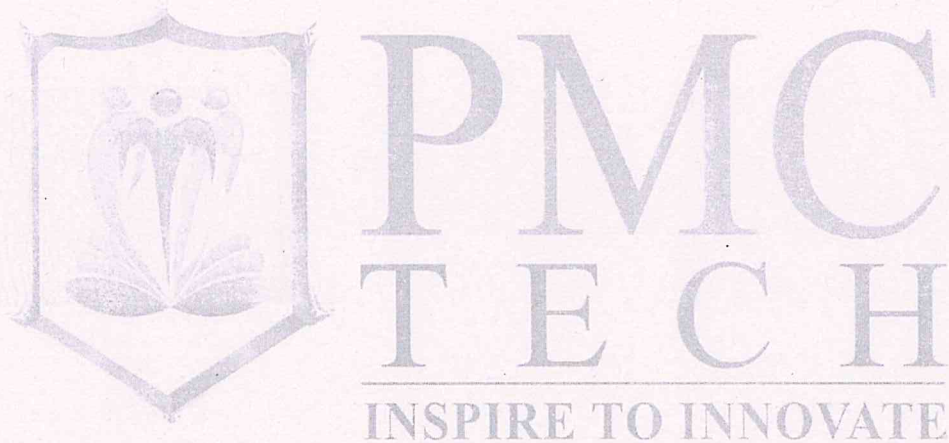
**REFERENCES:**

1.Ian H.Wittel, Eibe Frank"Data Mining-Practical Machine Learning Tools and Techniques ", Morgan Kaufman Publications,Third Edition , 2011.

2.David Hand, HeikkiMannila and Padhraic Smyth," Principles of Data Mining", MIT PRESS,2011.

**NPTEL/ SWAYAM/ MOOC REFERENCE:**

1.https://onlinecourses.nptel.ac.in/noc21_cs06/preview
2.https://onlinecourses.nptel.ac.in/noc20_cs92/preview

ME(CSE)45

## SEMESTER II ELECTIVE II

| S.NO. | COURSE CODE | COURSENAME | CATEGORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| THEORY | | | | | | | | |
| 1. | PPCS2PE04 | BLOCKCHAIN TECHNOLOGIES | PE | 3 | - | - | 3 | 3 |
| 2. | PPCS2PE05 | AGILE METHODOLOGIES | PE | 3 | - | - | 3 | 3 |
| 3. | PPCS2PE06 | SOFTWARE QUALITY ASSURANCE | PE | 3 | - | - | 3 | 3 |

ME(CSE)46

| PPCS2PE04 | BLOCKCHAIN TECHNOLOGIES | L T P C |
|---|---|---|
| | | 3 0 0 3 |

## COURSE OBJECTIVE

- To learn the fundamentals of Blockchain.
- To obtain knowledge about technologies of Blockchain.
- To incorporate the models of Blockchain- Ethereum.
- To learn the models of Hyperledger Fabric.

### UNIT I: INTRODUCTION 9

Basic Cryptographic primitives used in Blockchain –Secure- Collision Resistant hash functions - Digital signature - Public key cryptosystems – Zero knowledge proof systems - Need for Distributed Record Keeping – Modelling faults and adversaries- Byzantine Generals problem - Consensus algorithms and their scalability problems - Why Nakamoto Came up with Blockchain based crypto currency

### UNITII: TECHNOLOGIES BORROWED IN BLOCKCHAIN 9

Technologies Borrowed in Blockchain –hash pointers- Consensus- Byzantine Models of fault tolerance- Digital cash etc.- Bitcoin blockchain - Wallet – Blocks - Merkley Tree - hardness of mining - Transaction verifiability - Anonymity - forks - Double spending - Mathematical analysis of properties of Bitcoin - Bitcoin- the challenges and solutions.

### UNIT III : MODELS FOR BLOCKCHAIN 9

Models f-GARAY model -RLA Model -Proof of Work (PoW) as random oracle -Formal treatment of consistency- Liveness and Fairness - Proof of Stake (PoS) based Chains -Hybrid models ( PoW + PoS) - Bitcoin scripting language and their use

### UNIT IV : ETHEREUM 9

Ethereum -Ethereum Virtual Machine (EVM) -Wallets for Ethereum -Solidity -Smart Contracts - The Turing Completeness of Smart Contract Languages and verification challenges- Using smart contracts to enforce legal contracts. Comparing Bitcoin scripting vs. Ethereum Smart Contracts-Some attacks on smart contracts

### UNIT - V: HYPERLEDGER FABRIC 9

Hyperledger fabric- the plug and play platform and mechanisms in permissioned block chain - Beyond Crypto currency – applications of block chain in cyber security- integrity of information- E-Governance and other contract enforcement mechanisms - Limitations of block chain as a technology and myths vs reality of blockchain technology

**TOTAL: 45 PERIODS**

ME(CSE)47

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

| COs | Course Outcomes | Cognitive level |
|-----|-----------------|-----------------|
| CO1 | Describe the fundamentals of Blockchain | Remember |
| CO2 | Illustrate the technologies of Blockchain | Understand |
| CO3 | Describe the models of Blockchain | Apply |
| CO4 | Analyze and demonstrate the Ethereum | Analyze |
| CO5 | Analyze and demonstrate Hyperledger fabric | Analyze |

**CO – PO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3 | 1 | 2 | 1 | 2 | 2 |
| CO2 | 3 | 1 | 1 | 1 | 2 | 2 |
| CO3 | 3 | 1 | 1 | 1 | 2 | 1 |
| CO4 | 3 | 1 | 1 | 1 | 2 | 1 |
| CO5 | 3 | 1 | 1 | 1 | 2 | 2 |

**TEXTBOOK:**

1. Joseph Bonneau et al, SoK: "Research perspectives and challenges for Bitcoin and cryptocurrency", IEEE Symposium on security and Privacy,2015
2. J.A.Garay et al, "The bitcoin backbone protocol - analysis and applications", EUROCRYPT 2015,Volume 2

**REFERENCES:**

1. R.Pass et al, "Analysis of Blockchain protocol in Asynchronous networks", EUROCRYPT 2017.
2. Pass et al," Fruitchain- a fair blockchain", PODC 2017

**NPTEL/ SWAYAM/ MOOC REFERENCE:**
1. https://medium.com/moatcoin/part-1-blockchain-simplified-notesnptel-71b876f5d300
2. https://www.javatpoint.com/blockchain-tutorial
3. https://intellipaat.com/blog/tutorial/blockchain-tutorial/

ME(CSE)48

| PPCS2PE05 | AGILE METHODOLOGIES | L T P C |
|---|---|---|
| | | 3 0 0 3 |

**COURSEOBJECTIVE**

- To learn the fundamental principles and practices associated with each of the agile development methods
- To apply the principlesandpracticesofagilesoftwaredevelopmentonaprojectofinterestandrelevancetothestudent.
- To provideagoodunderstandingofsoftwaredesignandasetofsoftwaretechnologiesandAPIs.
- To do a detailed examinationanddemonstrationofAgiledevelopmentandtestingtechniques.
- To understand Agile development and testing.

### UNITI:AGILESOFTWAREDEVELOPMENT 9

Basics and Fundamentals of Agile Process Methods-Values of Agile-Principles of Agile-stakeholders -Challenges. Lean Approach: Waste Management-Kaizen and Kanban- add process and products add value. Roles related to the lifecycle-differences between Agile and traditional plan-differences between Agile plans at different lifecycle phases. Testing plan links between testing-roles and key techniques - principles -understand as a means of assessing the initial status of a project/How Agile helps to build quality.

### UNITIIAGILEANDSCRUMPRINCIPLES 9

Agile Manifesto-Twelve Practices of XP-Scrum Practices-Applying Scrum.Need of scrum-working of scrum-advanced Scrum Applications-Scrum and the Organization --scrum values.

### UNITIII AGILEPRODUCTMANAGEMENT 9

Communication,Planning-Estimation Managing the Agile approach Monitoring progress-Targeting and motivating the team –Managing business involvement-Escalating issue.Quality,Risk, Metrics and Measurements, Managing the Agile approach Monitoring progress - Targeting andmotivating the team,Managing business involvement and Escalating issue.

### UNITIV-AGILEREQUIREMENTSAND AGILETESTING 9

User Stories - Backlog Management. Agile Architecture: Feature Driven Development. Agile Risk Management: Risk and Quality Assurance -Agile Tools. Agile Testing Techniques -Test-Driven Development-User Acceptance Test

### UNIT-V:AGILEREVIEWANDSCALINGAGILEFORLARGEPROJECTS 9

Agile Metrics and Measurements-The Agile approach to estimating and project variables-Agile Measurement, Agile Control:the 7 control parameters.Agile approach to Risk-The Agile approach to Configuration Management-The Atern Principles-AternPhilosophy-The rational reforusing Atern-Refactoring Continuous integration –Automated Build Tools. Scrum of Scrums,Team collaborations, Scrum, Estimate a Scrum Project - Track Scrum Projects - Communication in Scrum Projects-Best Practices to Manage Scrum.

**TOTAL:45 PERIODS**

ME(CSE)49

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

| COs | Course Outcomes | Cognitive level |
|-----|-----------------|-----------------|
| CO1 | Analyze existing problems with the team, development process | Remember |
| CO2 | Apply thorough understanding of Agile principles and specific practices | Apply |
| CO3 | Infer the most appropriate way to improve results for a specific circumstance | Apply |
| CO4 | Apply appropriate adaptations to existing practices or processes Depending upon analysis of typical problems | Apply |
| CO5 | Evaluate likely successes and formulate plans to manage likely risks | Apply |

**CO–PO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3 | 2 | 2 | 3 | 1 | 3 |
| CO2 | 3 | 2 | 3 | 2 | 2 | 3 |
| CO3 | 3 | 2 | 3 | 1 | 1 | 2 |
| CO4 | 3 | 2 | 3 | 2 | 1 | 1 |
| CO5 | 3 | 3 | 3 | 1 | 1 | 1 |

**TEXTBOOKS:**

1. Robert C. Martin ,Agile Software Development, Principles, Patterns, and Practices Alan Apt Series(2011)
2. Succeeding with Agile: Software Development Using Scrum, Pearson(2010)

**REFERENCES:**

3. Hazza and Dubinsky, "Agile Software Engineering, Series: Undergraduate Topics inComputerScience,Springer,2019.
4. CraigLarman,"AgileandIterativeDevelopment:AManagersGuide,Addison-Wesley,2014.
5. Kevin C. Desouza, "Agile Information Systems: Conceptualization, Construction, and Management,Butterworth-Heinemann,2017.

**NPTEL/SWAYAM/MOOCREFERENCE:**

1. https://nptel.ac.in/courses/106105182
2. https://elearn.nptel.ac.in/shop/iit-workshops/completed/agile-testing-methodology-and-project-management-test-automation/

ME(CSE)50

| PPCS2PE06 | SOFTWARE QUALITY ASSURANCE | L T P C |
|---|---|---|
| | | 3 0 0 3 |

## COURSE OBJECTIVE

- Be exposed to the software quality factors, Quality Assurance (SQA) architecture and SQA components.
- Understand the integration of SQA components into the project life cycle.
- Be familiar with the software quality infrastructure.
- Be exposed to the management components of software quality.
- Be familiar with the Quality standards, certifications and assessments

### UNIT I: INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE 9

Need for Software quality – Software quality assurance (SQA) – Software quality factors- McCall's quality model – SQA system components – Pre project quality components – Development and quality plans.

### UNIT II :SQA COMPONENTS AND PROJECT LIFE CYCLE 9

Integrating quality activities in the project life cycle – Reviews – Software Testing – Quality of software maintenance components – Quality assurance for external participants contribution – CASE tools for software quality Management.

### UNIT III :SOFTWARE QUALITY INFRASTRUCTURE 9

Procedures and work instructions – Supporting quality devices - Staff training and certification - Corrective and preventive actions – Configuration management – Software change control – Configuration management audit -Documentation control.

### UNIT IV :SOFTWARE QUALITY MANAGEMENT & METRICS 9

Project process control – Software quality metrics – Cost of software quality – Classical quality cost model – Extended model – Application and Problems in application of Cost model

### UNIT V: STANDARDS, CERTIFICATIONS & ASSESSMENTS 9

Quality management standards – ISO 9001 and ISO 9000-3 –Capability Maturity Models – CMM and CMMI assessment methodologies - Bootstrap methodology – SPICE Project – SQA project process standards – Organization of Quality Assurance – Role of management in SQA – SQA units and other actors in SQA systems.

**TOTAL: 45 PERIODS**

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

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Utilize the concepts of SQA in software development life cycle | Remember |
| CO2 | Demonstrate their capability to adopt quality standards. | Apply |
| CO3 | Assess the quality of software products. | Apply |
| CO4 | Apply the concepts in preparing the quality plan & documents. | Apply |
| CO5 | Ensure whether the product meets company's quality standards and client's expectations and demands . | Apply |

## CO – PO Mapping:

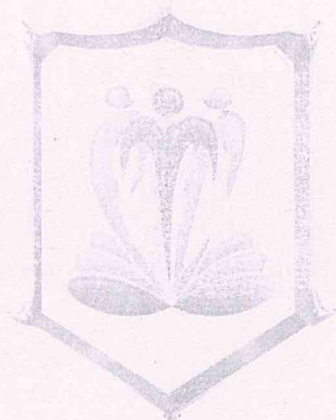| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 3 | 1 | 3 |
| CO2 | 3 | 2 | 3 | 2 | 2 | 3 |
| CO3 | 3 | 2 | 3 | 1 | 1 | 2 |
| CO4 | 3 | 2 | 3 | 2 | 1 | 1 |
| CO5 | 3 | 3 | 3 | 1 | 1 | 1 |

**TEXTBOOKS:**

1. Daniel Galin, "Software Quality Assurance", Pearson Publication, 2019.

2. Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press, 2011.

**REFERENCES:**

1. Kshirasagar Naim and Priyadarshi Tripathy," Software Testing and Quality Assurance Theory and Practice", John Wiley & Sons Inc., 2018

2. Mordechai Ben-Menachem "Software Quality: Producing Practical Consistent Software", International Thompson Computer Press, 2014

**NPTEL/ SWAYAM/ MOOC REFERENCE:**

https://onlinecourses.nptel.ac.in/noc22_cs61

| S.N O. | COURSE CODE | COURSENAME | CATEGORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| THEORY | | | | | | | | |
| 1. | PPCS2PE07 | INTERNET OF THINGS AND CLOUD | PE | 3 | - | - | 3 | 3 |
| 2. | PPCS2PE08 | NATURAL LANGUAGE PROCESSING | PE | 3 | - | - | 3 | 3 |
| 3. | PPCS2PE09 | DATA VISUALIZATION TECHNIQUES | PE | 3 | - | - | 3 | 3 |

ME(CSE)53

| PPCS2PE07 | INTERNET OF THINGS AND CLOUD | LTPC |
|---|---|---|
| | | 3003 |

**COURSE OBJECTIVE**

- To Understand the Architectural Overview of IoT
- To Understand the IoT Reference Architecture and Real World Design Constraints
- To Understand the various IoT levels
- To understand the basics of cloud architecture
- To gain experience in Raspberry PI and experiment simple IoT application on it

**UNIT I: FUNDAMENTALS OF IOT**     9

Evolution of Internet of Things- Domain Specific IoTs - IoT and M2M- Functional blocks oof an IoT ecosystem - Sensors for IoT Applications–Structure of IoT– IoT Map Device- IoT System Management with NETCONF-YANG

**UNIT II : IoT ARCHITECTURE, GENERATIONS AND PROTOCOLS**     9

IETF architecture for IoT - IoT reference architecture -First Generation – Description & Characteristics–Advanced Generation – Description & Characteristics–Integrated IoT Sensors –Description & Characteristics

**UNIT III : IoT PROTOCOLS AND TECHNOLOGY**     9

SCADA and RFID Protocols - BACnet Protocol -Zigbee Architecture 6LowPAN - CoAP - MQTT-Wireless Sensor Structure–

Energy Storage Module–Power Management Module–RF Module–Sensing Module

**UNIT IV: CLOUD ARCHITECTURE BASICS**     9

The Cloud types; IaaS, PaaS, SaaS.- Development environments for service development; Amazon, Azure, Google Appcloud platform in industry

**UNIT V: IOT PROJECTS ON RASPBERRY PI**     9

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System,IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

**TOTAL: 45 PERIODS**

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

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Describe the various concept of the IoT and their technologies. | Understand |
| CO2 | Develop the IoT application using different hardware platforms | Create |
| CO3 | Implement the various IoT Protocols | Apply |
| CO4 | Illustrate the basic principles of cloud computing | Understand |
| CO5 | Develop and deploy the IoT application into cloud environment | Create |

**CO – PO Mapping:**

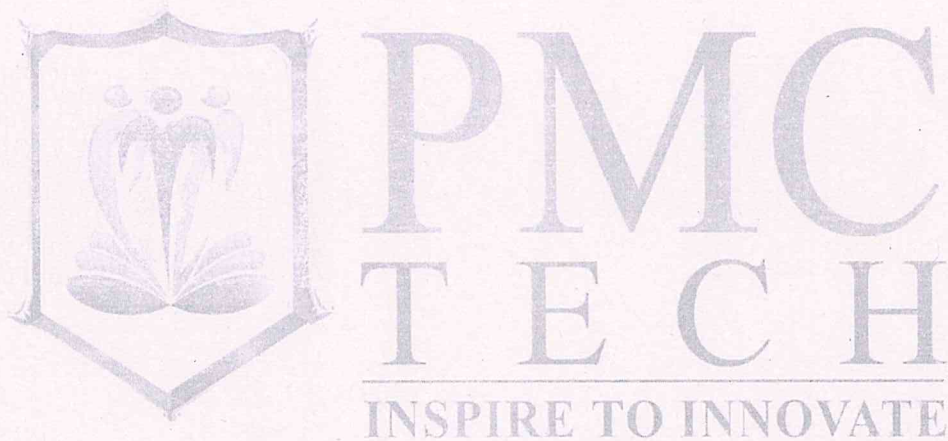| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 2 | 1 | 2 | 2 |
| CO2 | 3 | 2 | 1 | 2 | 2 | 2 |
| CO3 | 1 | 1 | 2 | 1 | 2 | 2 |
| CO4 | 2 | 3 | 2 | 3 | 3 | 3 |
| CO5 | 1 | 2 | 1 | 2 | 3 | 3 |

ME(CSE)54

**TEXTBOOKS:**

1.Arshdeep Bahga, Vijay Madisetti, Internet of Things: A hands-on approach, Universities Press, 2015

2. Dieter Uckelmann, Mark Harrison, Florian Michahelles (Eds), Architecting the Internet of Things, Springer, 2011

**REFERENCES:**

1. N. Ida, Sensors, Actuators and Their Interfaces: A Multidisciplinary Introduction, 2nd Edition Sci tech Publishers, 2014.

2. Reese, G. (2009). Cloud Application Architectures: Building Applications and Infrastructure in the Cloud. Sebastopol, CA: O'Reilly Media, Inc. (2019)

**NPTEL/ SWAYAM/ MOOC REFERENCE:**

1.https://onlinecourses.nptel.ac.in/noc22_cs53/preview

2.https://onlinecourses.nptel.ac.in/noc19_cs65/preview

ME(CSE)55

| PPCS2PE08 | NATURAL LANGUAGE PROCESSING | L T P C |
|---|---|---|
| | | 3 0 0 3 |

**COURSE OBJECTIVE**
- To understand basics of linguistics, probability and statistics
- To study statistical approaches to NLP and understand sequence labeling
- To outline different parsing techniques associated with NLP
- To explore semantics of words and semantic role labeling of sentences
- To understand discourse analysis, question answering and chatbots

**UNIT I: INTRODUCTION** 9

Natural Language Processing – Components - Basics of Linguistics and Probability and Statistics – Words-Tokenization-Morphology-Finite State Automata

**UNIT II: STATISTICAL NLP AND SEQUENCE LABELING** 9

N-grams and Language models –Smoothing -Text classification- Naïve Bayes classifier – Evaluation - Vector Semantics – TF-IDF - Word2Vec- Evaluating Vector Models -Sequence Labeling – Part of Speech – Part of Speech Tagging -Named Entities –Named Entity Tagging

**UNIT III: CONTEXTUAL EMBEDDING** 9

Constituency –Context Free Grammar –Lexicalized Grammars- CKY Parsing – Earley's algorithm-Evaluating Parsers -Partial Parsing – Dependency Relations- Dependency Parsing - Transition Based - Graph Based

**UNIT IV: COMPUTATIONAL SEMANTICS** 9

Word Senses **and** WordNet – Word Sense Disambiguation – Semantic Role Labeling – Proposition Bank- FrameNet- Selectional Restrictions - Information Extraction - Template Filling

**UNIT V: DISCOURSE ANALYSIS AND SPEECH PROCESSING** 9

Discourse Coherence – Discourse Structure Parsing – Centering and Entity Based Coherence – Question Answering –Factoid Question Answering – Classical QA Models – Chatbots and Dialogue systems – Frame-based Dialogue Systems – Dialogue–State Architecture

| | **TOTAL: 45 PERIODS** |
|---|---|

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

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Illustrate the basics of linguistics, probability and statistics associated with NLP. | Understand |
| CO2 | Implement a Part-of-Speech Tagger | Apply |
| CO3 | Design and implement a sequence labeling problem for a given domain | Create |
| CO4 | Implement semantic processing tasks and simple document indexing and searching system using the concepts of NLP | Apply |
| CO5 | Implement a simple chatbot using dialogue system concepts | Apply |

**CO-PO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | - | 2 | 3 | 1 | 1 | - |
| CO2 | 2 | 2 | 2 | 3 | - | 3 |
| CO3 | 3 | - | 3 | 3 | 3 | 3 |
| CO4 | 1 | - | 2 | 3 | 2 | 3 |
| CO5 | 1 | - | 2 | 3 | 2 | 3 |

**TEXTBOOKS:**

1.Daniel Jurafsky and James H.Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition" (Prentice Hall Series in Artificial Intelligence), 2020

2. Jacob Eisenstein. "Natural Language Processing ", MIT Press, 2019

**REFERENCES**

1. Samuel Burns "Natural Language Processing: A Quick Introduction to NLP with Python and NLTK, 2019

2. Christopher Manning, "Foundations of Statistical Natural Language Processing", MIT Press, 2009.

3. Nitin Indurkhya,Fred J. Damerau, "Handbook of Natural Language Processing", Second edition, Chapman & Hall/CRC: Machine Learning & Pattern Recognition, Hardcover,2010

4. Deepti Chopra, Nisheeth Joshi, "Mastering Natural Language Processing with Python", Packt Publishing Limited, 2016

5. Mohamed Zakaria Kurdi "Natural Language Processing and Computational Linguistics: Speech, Morphology and Syntax (Cognitive Science)", ISTE Ltd., 2016.

**NPTEL/ SWAYAM/ MOOC REFERENCE:**

1. https://onlinecourses.nptel.ac.in/noc23_cs45/preview  -   natural-language-processing  Prof. Pawan Goyal

2. https://onlinecourses.nptel.ac.in/noc20_cs87/preview - natural-language-processing  Prof. Ramaseshan R

ME(CSE)57

| PPCS2PE09 | DATA VISUALIZATION TECHNIQUES | L T P C |
|---|---|---|
| | | 3 0 0 3 |

## COURSE OBJECTIVE

- To introduce visual perception and core skills for visual analysis.
- To visualize time-series, part-to-whole and ranking analysis patterns.
- To analyze the deviation and distribution of data in real time.
- To analyze correlation and multivariate patterns of data.
- To understand issues and best practices in information dashboard design.

### UNIT I: BUILDING CORE SKILLS FOR VISUALANALYSIS                                     9

Information Visualization -- Prerequisites for Enlightening Analysis: Aptitudes and attitudes of effective Analysts -- Traits of meaningful data; Power of Visual Perception -- How Visual Perception Works -- Making Abstract Data Visible -- Analytical Interaction -- Analytical Navigation – Optimal Quantitative Scales -- Reference Lines and Regions -- Trellises and Crosstabs -- Multiple Concurrent Views -- Focus and Context -- Details on Demand -- Over-plotting reduction.

### UNITII:TECHNOLOGIES BORROWED IN BLOCKCHAIN                                          9

Technologies Borrowed in Blockchain –hash pointers- Consensus- Byzantine Models of fault tolerance- Digital cash etc.- Bitcoin blockchain - Wallet – Blocks - Merkley Tree - hardness of mining - Transaction verifiability - Anonymity - forks - Double spending - Mathematical analysis of properties of Bitcoin - Bitcoin- the challenges and solutions.

### UNIT III :  DEVIATION ANALYSIS AND DISTRIBUTION ANALYSIS                            9

Deviation Analysis: Introduction -- Deviation analysis displays -- Deviation analysis techniques and best practices; Distribution Analysis: Introduction -- Describing distributions - Distribution patterns -- Distribution displays -- Distribution analysis techniques and best practices; Creating plots for deviation and distribution analysis.

### UNIT IV : CORRELATION ANALYSIS AND MULTIVARIATE ANALYSIS                           9

Correlation Analysis: Introduction -- Describing correlations -- Correlation patterns -- Correlation displays -- Correlation analysis techniques and best practices; Multivariate Analysis: Introduction -- Multivariate patterns -- Multivariate displays -- Multivariate analysis techniques and best practices; Creating graphs and heatmaps for correlation and multivariate analysis of data.

### UNIT - V: INFORMATION DASHBOARD DESIGN                                             9

Information Dashboard: Definition -- Thirteen Common Mistakes in Dashboard Design -- Gestalt Principles of Visual Perception -- Characteristics of Well-designed Dashboard – Designing Dashboards for Usability -- Creating a Simple Dashboard using Metabase

| | TOTAL: 45 PERIODS |
|---|---|

ME(CSE)58

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

| COs | Course Outcomes | Cognitive level |
|-----|-----------------|-----------------|
| CO1 | Explain the core skills for visual analysis | Understand |
| CO2 | Apply visualization techniques for time-series data and ranking patterns | Apply |
| CO3 | Apply visualization techniques for finding the deviation and distribution of data patterns | Apply |
| CO4 | Analyze correlation and multivariate patterns among data | Analyze |
| CO5 | Explain the characteristics of dashboard and develop dashboard for simple applications | Analyze |

**CO – PO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3 | 1 | 2 | 1 | 2 | – |
| CO2 | 3 | 1 | 1 | 1 | 2 | – |
| CO3 | 3 | 1 | 1 | 1 | 2 | – |
| CO4 | 3 | 1 | 1 | 1 | 2 | – |
| CO5 | 3 | 1 | 1 | 1 | 2 | – |

**TEXTBOOK:**

1. Stephen Few, "Now you see it: Simple Visualization techniques for quantitative analysis",Analytics Press, 2019. (Units I, II, III, IV)
2. Stephen Few, "Information dashboard design: The Effective Visual Communication of Data",First edition, O'Reilly, 2016. (Unit V)

**REFERENCES:**

1. Tim Abraham, "Metabase Up and Running", Packt Publishing Limited, 2020.

2. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment",O'Reilly, 2018.

3. Edward R. Tufte, "The visual display of quantitative information", Second Edition, Graphics Press, 2011.

4. Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.

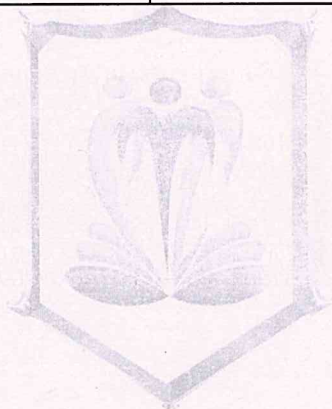5. Tamara Munzner, "Visualization Analysis and Design", AK Peters Visualization Series, CRC Press, 2014

**NPTEL/ SWAYAM/ MOOC REFERENCE:**

1. https://elearn.nptel.ac.in/shop/iit-workshops/completed/data-visualization-with-r/
2. https://freevideolectures.com/course/4041/nptel-introduction-to-learning-analytics/11

ME(CSE)59

## SEMESTER III ELECTIVE IV

| S.NO. | COURSE CODE | COURSENAME | CATEGORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|-------|-------------|------------|----------|---|---|---|---|---|
|       |             |            |          | L | T | P |   |   |
| THEORY | | | | | | | | |
| 1. | PPCS3PE10 | Principles of Data Science | PE | 3 | - | - | 3 | 3 |
| 2. | PPCS3PE11 | Bioinformatics | PE | 3 | - | - | 3 | 3 |
| 3. | PPCS3PE12 | Cloud Security | PE | 3 | - | - | 3 | 3 |

ME(CSE)60

| PPCS3PE10 | | PRINCIPLES OF DATA SCIENCE | L T P C |
|---|---|---|---|
| | | | 3 0 0 3 |

## COURSE OBJECTIVE

- To understand statistical inference in the process of conducting analysis of real-world datasets.
- To expose the fundamental concepts and techniques in data science.
- To learn the application of probability in data science.
- To gain knowledge on predictions using regression and classification methods.
- To explore critically about data and bring in robust conclusions.

| UNIT I: INTRODUCTION | 9 |
|---|---|

Data Science – Introduction - Computational Tools - Statistical Techniques - Need for Data Science –Data Science Life Cycle– Roles – Data Scientists – Data Analysts – Data Engineer – Data Science Tools.

| UNIT II: PROBABILITY AND DISTRIBUTIONS | 9 |
|---|---|

Finding Probabilities - Sampling - Empirical Distributions - Testing Hypotheses - Assessing Models - Multiple Categories - Decisions and Uncertainty - Error Probabilities - Comparing Two Samples - A/B Testing –Deflategate - Causality - Estimation – Mean –Variability – Standard Deviation - Normal Curve - The Central Limit Theorem - Choosing Sample Size.

| UNIT III: REGRESSION | 9 |
|---|---|

Prediction - Correlation - The Regression Line - The Method of Least Squares - Least Squares Regression - Visual Diagnostics - Numerical Diagnostics - Inference for Regression - A Regression Model - Inference for the True Slope - Prediction Intervals - Multiple Regression.

| UNIT IV: CLASSIFICATION | 9 |
|---|---|

Classification - Nearest Neighbours - Training and Testing - Rows of Tables - Implementing the Classifier – Performance Measures - Updating Predictions - Binary Classifier - Making Decisions.

| UNIT - V: VISUALIZATION | 9 |
|---|---|

Visualization – Scatter Plots – Line Plots - Categorical Distributions – Numerical Distributions – Applications – Case Study.

| | TOTAL: 45 PERIODS |
|---|---|

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

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Apply statistical techniques for data analysis | Apply |
| CO2 | Describe the role of Sampling and Distributions in data analysis | Apply |
| CO3 | Implement regression algorithms for numerical data. | Apply |
| CO4 | Measure the performance using classification algorithms for categorical data | Evaluate |
| CO5 | Demonstrate data visualization and discuss how data can be used responsibly to benefit society. | Apply |

## CO – PO Mapping:

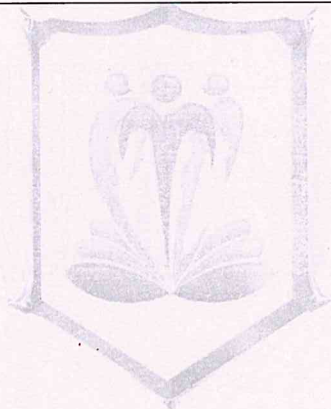| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | 2 | 2 | 2 |
| CO2 | 3 | 2 | 2 | 2 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 2 | 2 | 2 |
| CO4 | 2 | 1 | 3 | 2 | 2 | 2 |
| CO5 | 2 | 2 | 1 | 2 | 2 | 2 |

ME(CCE) 61

**TEXTBOOK:**

1. Ani Adhikari and John DeNero, ―Computational and Inferential Thinking: The Foundations of Data Science‖, 2019.

**REFERENCES:**

1. The Art of Data Science: A Guide for Anyone Who Works with Data, Roger D. Peng, and Elizabeth Matsui, ISBN: 9781365061462, 2018.

2. The Big Book of Dashboards: Visualizing Your Data Using Real-World Business Scenarios. by Steve Wexler, Jeffrey Shaffer, Andy Cotgreave, ISBN: 1119282713,2017

**NPTEL**

1. https://nptel.ac.in/courses/106106179
2. https://nptel.ac.in/courses/106105186

| PPCS3PE11 | BIOINFORMATICS | L T P C |
|-----------|----------------|---------|
|           |                | 3 0 0 3 |

**COURSE OBJECTIVE**

- To understand the concept and need of Bioinformatics.
- To transform biological data into knowledge and perform data analysis.
- To learn machine learning algorithms for bioinformatics
- To learn hidden Markov modeling and probabilistic modeling
- To know the importance of microarray data analysis

| UNIT I: INTRODUCTION | 9 |
|----------------------|---|

Introduction to Bioinformatics: Need for Bioinformatics technologies -- Overview of Bioinformatics technologies; Overview of structural bioinformatics: Organization of structural bioinformatics – Primary resource: protein data bank -- Secondary resources and applications.

| UNIT II: DATA WAREHOUSING AND DATA MINING IN BIOINFORMATICS | 9 |
|-------------------------------------------------------------|---|

Data warehousing in Bioinformatics: Bioinformatics data -- Transforming data to knowledge -- Data warehousing architecture -- Data quality; Data mining for Bioinformatics: Biomedical data analysis -- DNA data analysis -- Protein data analysis.

| UNIT III: MACHINE LEARNING IN BIOINFORMATICS | 9 |
|----------------------------------------------|---|

Machine learning in Bioinformatics: Artificial neural network – Neural network architecture and applications -- Genetic algorithm – Fuzzy system; Genome Analyses; Transcriptome Analyses.

| UNIT IV: MODELING FOR BIOINFORMATICS | 9 |
|--------------------------------------|---|

Modeling for Bioinformatics: Hidden Markov modeling for biological data analysis -- Comparative modeling -- Probabilistic modeling -- Molecular modeling

| UNIT - V: MICROARRAY DATA ANALYSIS | 9 |
|------------------------------------|---|

Microarray Data Analysis: Microarray technology for genome expression study -- Image analysis for data extraction -- Data Analysis for Pattern Discovery

**TOTAL: 45 PERIODS**

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

| COs | Course Outcomes | Cognitive level |
|-----|-----------------|-----------------|
| CO1 | Explain the concept and need of bioinformatics | Understand |
| CO2 | Identify genome, protein data and their equivalent storage and mining process | Apply |
| CO3 | Apply machine learning algorithms on bioinformatics data | Apply |
| CO4 | Apply Hidden Markov Modeling and probabilistic modeling for bioinformatics data | Apply |
| CO5 | Infer the importance of microarray data analysis | Understand |

**CO – PO Mapping:**

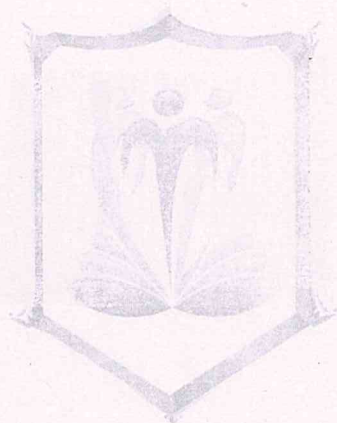| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|-----|-----|-----|-----|-----|-----|-----|
| CO1 | –   | –   | 3   | 2   | 2   | 2   |
| CO2 | –   | –   | 2   | 2   | 2   | 2   |
| CO3 | –   | –   | 2   | 2   | 2   | 2   |
| CO4 | –   | –   | 3   | 2   | 2   | 2   |
| CO5 | –   | –   | 1   | 2   | 2   | 2   |

**TEXTBOOK:**

1.  Yi-Ping Phoebe Chen (Ed), "Bioinformatics Technologies", First Indian Reprint, Springer Verlag, 2017 (Units 1, 2 3, 4, 5)

**REFERENCES:**

**1.** Arthur M Lesk, "Introduction to Bioinformatics", Fourth Edition, Oxford University Press, 2018

2. Rui Jiang, Xuegong Zhang, Michael Q Zhang, "Basics of Bioinformatics", Tsinghua University Press, Springer, 2013

**NPTEL**

- https://onlinecourses.nptel.ac.in/noc21_bt06/preview
- https://onlinecourses.swayam2.ac.in/cec21_bt04/preview

ME(CSE)63

| PPCS3PE12 | CLOUD SECURITY | L T P C |
|---|---|---|
| **COURSE OBJECTIVE** | | 3 0 0 3 |

- To expose the basic knowledge on security issues from the cloud providers and users' perspective.
- To get familiarize the fundamental security principles of private and public cloud.
- To gain procedure to create prototype for cloud security.
- To gather information on threats, risks, vulnerabilities, side- channel attacks and privacy issues associated with cloud-base IT services.
- To study the security architectures that assure secure isolation of physical and logical infrastructures.

| UNIT I: INTRODUCTION TO CLOUD COMPUTING AND SECURITY | 9 |
|---|---|

Understanding Cloud Computing-The IT Foundation for Cloud-Cloud Computing Architecture-Cloud Reference Architecture-Control over Security in the Cloud Model-Making Sense of Cloud Deployment-Making Sense of Services Models-How Clouds Are Formed and Key Examples-Real- world Cloud Usage Scenarios.

| UNIT II: SECURITY RISK ISSUES AND ARCHITECTURE | 9 |
|---|---|

Cloud Computing: Security Concerns-Assessing Your Risk Tolerance in Cloud Computing-Legal and Regulatory Issues-Security Requirements for the Architecture-Security Patterns and Architectural Elements- Cloud Security Architecture-Planning Key Strategies for Secure Operation.

| UNIT III: SECURING THE CLOUD :DATA SECURITY | 9 |
|---|---|

Overview of Data Security in Cloud Computing- Data Encryption: Applications and Limits- Cloud Data Security: Sensitive Data Categorization- Cloud Data Storage-Cloud Lock-in-Securing the Cloud :Key Strategies and Best Practices- Overview of Security Controls- The Limits of Security Controls-Security Monitoring.

| UNIT IV: SECURITY CRITERIA :BUILDING AN INTERNAL CLOUD | 9 |
|---|---|

Private Clouds: Motivation and Overview- Security Criteria for Ensuring A Private Cloud- Security Criteria :Selecting an External Cloud Provider- Selecting a CSP :Over view of Assurance-Overview of Risks –Security Criteria.

| UNIT - V: EVALUATING CLOUD SECURITY: AN INFORMATION SECURITY FRAME WORK | 9 |
|---|---|

Evaluating Cloud Security- Checklists for Evaluating Cloud Security- Metrics for the Check lists - Operating a Cloud - From Architecture to Efficient and Secure Operations-Security Operations Activities.

**TOTAL: 45 PERIODS**

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

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Comprehend the basics of cloud platforms and risk issues in cloud computing. | Understand |
| CO2 | Describe cloud security architecture, challenges and requirements. | Understand |
| CO3 | Explain and implement various core security controls for cloud computing. | Understand |
| CO4 | Identify the best practices and strategies for a secure cloud environment. | Analyze |
| CO5 | Illustrate how to perform security analytics in cloud platform. | Understand |

**CO – PO Mapping:**

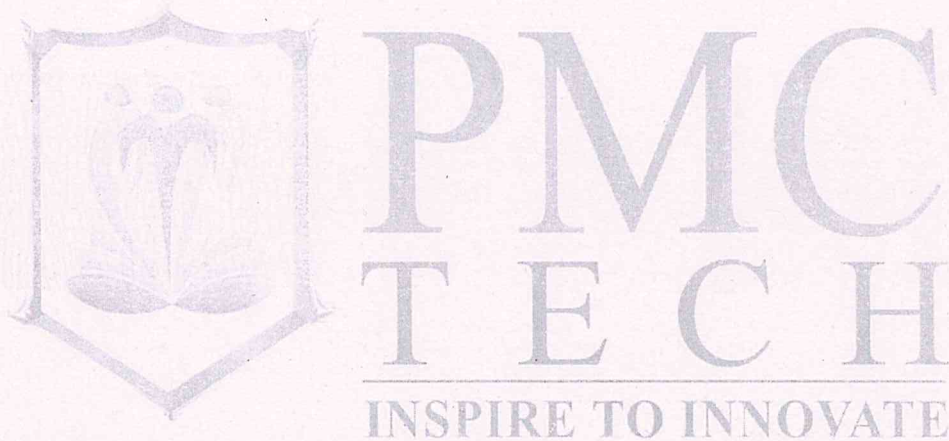| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | - | 1 | - | 2 | 1 | - |
| CO2 | - | 1 | - | 2 | 1 | - |
| CO3 | - | 1 | - | 2 | 1 | 2 |
| CO4 | 2 | 1 | - | 2 | 1 | 1 |
| CO5 | - | 1 | - | 2 | 1 | 1 |

ME(CSE)64

**TEXT BOOKS:**

1. Winkler, Vic JR. ―Securing the Cloud : Cloud computer Security techniques and tactics,Netherlands,Firstedition,2017.

2. Cope, Robert, et al. CloudComputing,Design Patterns. UnitedKingdom, Pearson Education, Netherlands, Second edition, 2015.

**REFERENCES:**

1. Mather, Tim, Subra Kumaraswamy, and Shahed Latif, ―Cloud security and privacy: an enterprise perspective on risks and compliance‖, O'Reilly Media, Inc.", California, First edition, 2009.

2. Krutz, Ronald L., and Russell Dean Vines, ―Cloud security: A comprehensive guide to secure cloud computing‖, Wiley Publishing, New Jersey, First edition, 2010.
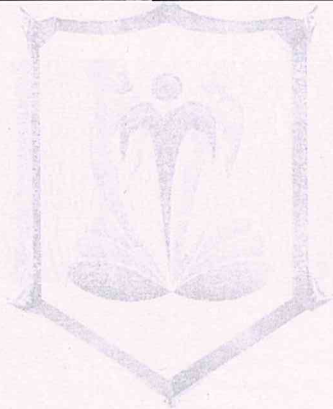
**NPTEL**

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

| S.N O. | COURSE CODE | COURSENAME | CATEGORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| THEORY | | | | | | | | |
| 1. | PPCS3PE13 | Image Processing | PE | 3 | - | - | 3 | 3 |
| 2. | PPCS3PE14 | Bio Inspired Computing | PE | 3 | - | - | 3 | 3 |
| 3. | PPCS3PE15 | Software Project Management | PE | 3 | - | - | 3 | 3 |

ME(CSE)6b

| PPCS3PE13 | IMAGE PROCESSING | L T P C |
|---|---|---|
| | | 3 0 0 3 |

## COURSE OBJECTIVE

- To provide knowledge on image formation and pre-processing.
- To explore various approaches for feature extraction
- To discover image processing techniques to enhance the quality of images
- To learn algorithms to create compressed patterns of images using image compression techniques.
- To study the image processing techniques using tools.

### UNIT I: FOUNDATION                                                                        9

Components of Image processing system – Image Representation –Neighborhood operations – Multi scale Representation.

### UNIT II: IMAGE FORMATION AND FEATURE EXTRACTION                                          9

Quantitative Visualization – Image formation – Digitization, Sampling and Quantization-Averaging — Box filter — Binomial filter - Edges — Generalproperties of Edge filters– Gradient Based Edge Detection - SimpleNeighborhood — Motion — Texture.

### UNIT III: IMAGE SEGMENTATION AND MODELING                                                9

Segmentation – Pixel based, Edge based, Region based, Model based segmentations - Regularization and modeling – Unifying local analysis andglobal knowledge – Diffusion models – Network models – Inverse filtering.

### UNIT IV: IMAGE ANALYSIS                                                                   9

Processing binary images- Correlation, Classification, Identification andMatching- Tomography- Methods for object measurement.

### UNIT V: PROGRAMMING                                                                       9

Applications – Handling image files – Establishing image processing tools –Correcting and enhancing images - Programming with Open CV.

**TOTAL: 45 PERIODS**

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

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Process images and identify patterns from images | Understand |
| CO2 | Apply image processing techniques to enhance the quality of images. | Apply |
| CO3 | Analyze various image transformation techniques to enhance images. | Analyze |
| CO4 | Create compressed patterns of images using image compressiontechniques. | Create |
| CO5 | Represent image using Open CV. | Apply |

## CO – PO Mapping:

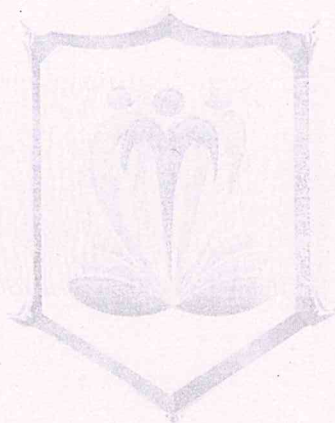| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 2 | - | - | 1 | - | 2 |
| CO2 | 2 | 1 | 1 | 2 | - | 1 |
| CO3 | 3 | 1 | 1 | 2 | - | 1 |
| CO4 | 2 | 2 | 2 | 2 | - | 1 |
| CO5 | 2 | - | - | 1 | - | 1 |

MF(CSE)67

**TEXTBOOK:**

1. John C Russ, —Image processing handbook, CRC Press, 7th Edition,ISBN: 9781498740289, 2016. Grewal B.S., —Higher Engineering Mathematicsǁ, Khanna Publishers, 43rd edition, New Delhi, 2012.

**REFERENCES:**

1. Gloria Bueno García et.al, —Learning Image Processing with OpenCV, Packt Publishing, 1st Edition, ISBN: 9781783287666, 2015.

2. Bernd Jahne, —Digital image processing, Springer Science and Business Media, 5th Edition, ISBN: 978366204781, 2013

**NPTEL**

1. https://archive.nptel.ac.in/courses/117/105/117105135/
2. https://nptel.ac.in/courses/117105135
3. https://archive.nptel.ac.in/courses/103/106/103106120/

ME(CSE)68

| PPCS3PE14 | BIO INSPIRED COMPUTING | L T P C |
|---|---|---|
| | | 3 0 0 3 |

## COURSE OBJECTIVE

- Understand the basics of biological systems
- Acquire knowledge on working of Evolutionary algorithms
- Gain the knowledge on the fundamentals and topological working of Artificial Neural Networks
- Conceive the fundamentals and working of Swarm Intelligence
- Explore the working of Immuno Computing Techniques

### UNIT-1 : INTRODUCTION                                                                                           9

Models of Life and Intelligence - Fundamentals of bio-inspired models and bio-inspired computing. Evolutionary models and techniques, Swarm models and its self-Organization, swarm and evolutionary algorithms. Optimization problems – single and multi-objective optimization, heuristic, meta-heuristic and hyper heuristic functions

### UNIT-2 : EVOLUTIONARY COMPUTING                                                                   9

Evolutionary Computing, Hill Climbing and Simulated Annealing, Darwin's Dangerous Idea, Genetics Principles, Standard Evolutionary Algorithm -Genetic Algorithms, Reproduction-Crossover, Mutation, Evolutionary Programming, Genetic Programming

### UNIT-3: NEURAL MODELS                                                                                      9

Biological nervous systems, artificial neural networks, evolution of neural networks,neuron models, architecture, unsupervised learning, supervised learning, reinforcement learning,Linear separability problem,signal encoding, synaptic plasticity, hybrid neural systems

### UNIT-4 : SWARM INTELLIGENCE                                                                         9

Introduction - Ant Colonies, Ant Foraging Behavior, Ant Colony Optimization, SACO and scope of ACO algorithms, Ant Colony Algorithm (ACA), Swarm Robotics, Foraging for food, Social Adaptation of Knowledge, Particle Swarm Optimization (PSO)

### UNIT-5: IMMUNO COMPUTING SYSTEMS                                                          9

Introduction- Immune System, Physiology and main components, Pattern Recognition and Binding, biological immune systems, lessons for artificial immune systems, algorithms and applications, shape space, negative selection algorithm, clonal selection algorithm, Bone Marrow Models, Forest's Algorithm

|  | **TOTAL: 45 PERIODS** |
|---|---|

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

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Exhibit knowledge on fundamental concepts of bio inspired computing | Understand |
| CO2 | Apply evolutionary algorithms and perform computing | Apply |
| CO3 | Design and develop simple neural network models | Apply |
| CO4 | Recommend appropriate swarm algorithm for building an AI model | Analyze |
| CO5 | Apply suitable Immuno Computing algorithm for a given problem | Apply |

**CO – PO Mapping:**

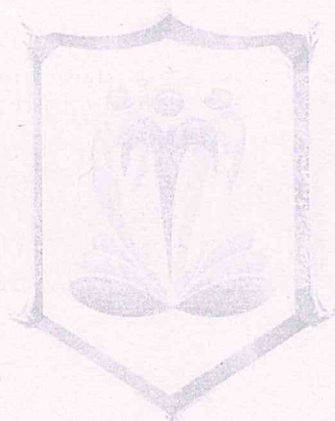| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PS01 | PS02 |
|---|---|---|---|---|---|---|---|---|
| CO1 | – | 2 | 2 | 1 | 3 | 2 | 2 | 3 |
| CO2 | – | 2 | 2 | 1 | 3 | 1 | 2 | 3 |
| CO3 | – | 2 | 2 | 2 | 3 | 1 | 2 | 3 |
| CO4 | – | 2 | 1 | 2 | 3 | 1 | 2 | 3 |
| CO5 | – | 2 | 3 | 2 | 3 | 1 | 2 | 3 |

MEII(E)69

**TEXT BOOKS:**

1. Leandro Nunes de Castro - " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2017
2. Floreano, D. and C. Mattiussi -"Bio-Inspired Artificial Intelligence: Theoriesethods, and Technologies"IT Press, 2018
3. Albert Y.Zomaya - "Handbook of Nature-Inspired and Innovative Computing", Springer, 2012

**REFERENCES:**

4. Marco Dorrigo, Thomas Stutzle -" Ant Colony Optimization", Prentice Hall of India, New Delhi, 2015
5. D. E. Goldberg, "Genetic algorithms in search, optimization, and machine learning", Addison- Wesley, 2019.
6. Simon O. Haykin, "Neural Networks and Learning Machines", Third Edition, Prentice Hall,2018

**NPTEL and Other Resources**

1. https://www.udemy.com/course/bio-inspired-artificial-intelligence-algorithms-for-optimization/
2. https://onlinecourses.nptel.ac.in/noc22_cs54/preview

| PPCS3PE15 | SOFTWARE PROJECT MANAGEMENT | L T P C |
|---|---|---|
| | | 3 0 0 3 |

## COURSE OBJECTIVE

- To know how to do project planning for the software process.
- To learn the cost estimation techniques during the analysis of the project.
- To understand the quality concepts for ensuring the functionality of the software

### UNIT I: SOFTWARE PROJECT MANAGEMENT CONCEPTS9

Introduction to Software Project Management: An Overview of Project Planning: Select Project, Identifying Project scope and objectives, infrastructure, project products and Characteristics. Estimate efforts, Identify activity risks, and allocate resources- Six Sigma, Software Quality: defining software quality, ISO9126, External Standards.

### UNIT II: SOFTWARE EVALUATION AND COSTING9

Project Evaluation: Strategic Assessment, Technical Assessment, cost-benefit analysis, Cash flow forecasting, cost-benefit evaluation techniques, Risk Evaluation. Selection of Appropriate Project approach: Choosing technologies, choice of process models, structured methods.

### UNIT III: SOFTWARE ESTIMATION TECHNIQUES9

Software Effort Estimation: Problems with over and under estimations, Basis of software Estimation, Software estimation techniques, expert Judgment, Estimating by analogy. Activity Planning: Project schedules, projects and activities, sequencing and scheduling Activities, networks planning models, formulating a network model.

### UNIT IV: RISK MANAGEMENT9

Risk Management: Nature of Risk, Managing Risk, Risk Identification and Analysis, Reducing the Risk. Resource Allocation: Scheduling resources, Critical Paths, Cost scheduling, Monitoring and Control: Creating Framework, cost monitoring, prioritizing monitoring.

### UNIT - V: GLOBALIZATION ISSUES IN PROJECT MANAGEMENT9

Globalization issues in project management: Evolution of globalization- challenges in building global teams-models for the execution of some effective management techniques for managing global teams. Impact of the internet on project management: Introduction – the effect of the internet on project management – managing projects for the internet – effect on project management activities. Comparison of project management software: dot Project, Launch pad, openProj. Case study: PRINCE2

**TOTAL: 45 PERIODS**

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

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Understand the activities during the project scheduling of any software application. | Understand |
| CO2 | Learn the risk management activities and the resource allocation for the projects. | Remember |
| CO3 | Apply the software estimation and recent quality standards for evaluation of the software projects | Apply |
| CO4 | Acquire knowledge and skills needed for the construction of highly reliable software project | Understand |
| CO5 | Create reliable, replicable cost estimation that links to the requirements of project planning and managing | Create |

**CO – PO Mapping:**

| CO | PO1 | PO2 | PO3 | FO4 | PO5 | PO6 |
|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 2 | 2 | 1 | 2 | 2 | 1 |
| CO2 | 2 | 2 | 1 | 2 | 2 | 1 |
| CO3 | 2 | 2 | 1 | 2 | 2 | 1 |
| CO4 | 2 | 2 | 1 | 2 | 2 | 1 |
| CO5 | 2 | 2 | 1 | 2 | 2 | 1 |

**TEXTBOOK:**

1. Bob Hughes, Mike Cotterell & Rajib Mall "Software Project Management", McGraw- Hill Publications, 6th Edition 2017.

2. Ian Somerville, "Software Engineering", 10th Edition, Pearson Education, 2017.

**REFERENCES:**

1. Robert T. Futrell , "Quality Software Project Management", Pearson Education India, 2018.

2. Gopalaswamy Ramesh, "Managing Global Software Projects: How to Lead Geographically Distributed Teams, Manage Processes and Use Quality Models", McGraw Hill Education, 2017.

3. Richard H.Thayer "Software Engineering Project Management", 2nd Edition, Wiley, 2016. 6. S. A. Kelkar," Software Project Management" PHI, New Delhi, Third Edition ,

**NPTEL**

1. https://archive.nptel.ac.in/courses/106/105/106105218/
2. https://freevideolectures.com/course/4071/nptel-software-project-management

**AUDIT COURSES**

| S.NO. | COURSE CODE | COURSE NAME | CATEGORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| THEORY | | | | | | | | |
| 1 | PPCS1AC01 | English for Research Paper Writing | AC | 2 | 0 | 0 | 2 | 2 |
| 2 | PPCS1AC02 | Disaster Management | AC | 2 | 0 | 0 | 2 | 2 |
| 3 | PPCS1AC03 | Constitution of India | AC | 2 | 0 | 0 | 2 | 2 |
| 4 | PPCS1AC04 | நற்றமிழ் இலக்கியம் | AC | 2 | 0 | 0 | 2 | 2 |
| | | Total | | 8 | 0 | 0 | 8 | 8 |

ME.(CSE)73

| PPCS1AC01 | ENGLISH FOR RESEARCH PAPER WRITING | L T P C |
|---|---|---|
| | | 2 0 0 0 |

## COURSE OBJECTIVE

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

## UNIT I INTRODUCTION TO RESEARCH PAPER WRITING 6

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

## UNIT II PRESENTATION SKILLS 6

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

## UNIT III TITLE WRITING SKILLS 6

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

## UNIT IV : RESULT WRITING SKILLS 6

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

## UNIT V VERIFICATION SKILLS 6

Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission

**TOTAL: 30 PERIODS**

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

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Understand that how to improve your writing skills and level of readability | Understand |
| CO2 | Learn about what to write in each section | Apply |
| CO3 | Understand the skills needed when writing a Title | Understand |
| CO4 | Understand the skills needed when writing the Conclusion | Understand |
| CO5 | Ensure the good quality of paper at very first-time submission | Analyze |

## CO – PO Mapping:

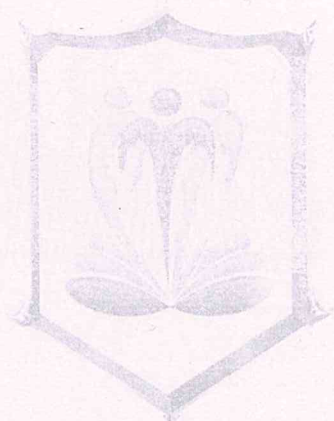| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 2 | 1 | 2 | 1 | 3 | 3 |
| CO2 | 3 | 1 | 1 | 1 | 2 | 1 | 3 | 3 |
| CO3 | 3 | 1 | 1 | 1 | 2 | 1 | 3 | 3 |
| CO4 | 3 | 1 | 1 | 1 | 2 | 1 | 3 | 3 |
| CO5 | 3 | 1 | 1 | 1 | 2 | 1 | 3 | 3 |

ME(CSE)74

**TEXTBOOK:**

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006

**REFERENCES:**

1.Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006

2. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's 5. book 1998

| PPCS1AC02 | DISASTER MANAGEMENT | L T P C |
|---|---|---|
| | | 2 0 0 0 |

**COURSE OBJECTIVE**

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations
- Develop the strengths and weaknesses of disaster management approaches

**UNIT I INTRODUCTION**     6

Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

**UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS**     6

Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

**UNIT III DISASTER PRONE AREAS IN INDIA**     6

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

**UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT**     6

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

**UNIT V RISK ASSESSMENT**     6

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

**TOTAL: 30 PERIODS**

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

| COs | Course Outcomes | Cognitive level |
|------|------------------|-----------------|
| CO1 | Ability to summarize basics of disaster | Understand |
| CO2 | Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response. | Apply |
| CO3 | Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives. | Understand |
| CO4 | Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations. | Understand |
| CO5 | Ability to develop the strengths and weaknesses of disaster management approaches | Analyze |

**CO – PO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|------|------|------|------|------|------|------|
| CO1 | 3 | 1 | 2 | 1 | 2 | – |
| CO2 | 3 | 1 | 1 | 1 | 2 | – |
| CO3 | 3 | 1 | 1 | 1 | 2 | – |
| CO4 | 3 | 1 | 1 | 1 | 2 | – |
| CO5 | 3 | 1 | 1 | 1 | 2 | – |

**TEXTBOOK:**
1. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi,2009.
2. NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company,2007.

**REFERENCES:**
1. Sahni, Pradeep Et.Al. ," Disaster Mitigation Experiences And Reflections", Prentice Hall OfIndia, New Delhi,2001.

| PPCS1AC03 | CONSTITUTION OF INDIA | L T P C |
|---|---|---|
| | | 2 0 0 0 |

## COURSE OBJECTIVE

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.

- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional

- Role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.

- Role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.

## UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION

History, Drafting Committee, (Composition & Working)

## UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION

Preamble, Salient Features

## UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

## UNIT IV ORGANS OF GOVERNANCE

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

## UNIT V LOCAL ADMINISTRATION

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of www.rejinpaul.com Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level:Role of Elected and Appointed officials, Importance of grass root democracy.

## UNIT VI ELECTION COMMISSION

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

**TOTAL: 30 PERIODS**

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

| COs | Course Outcomes | Cognitive level |
|-----|-----------------|-----------------|
| CO1 | Students will be able to Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics. | Understand |
| CO2 | Students will be able to Discuss the intellectual origins of the framework of argument that informed the conceptualization | Apply |
| CO3 | Students will be able to of social reforms leading to revolution in India. | Understand |
| CO4 | Students will be able to Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution. | Understand |
| CO5 | Students will be able to Discuss the passage of the Hindu Code Bill of 1956. | Analyze |

**CO – PO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3 | 1 | 2 | 1 | 2 | – |
| CO2 | 3 | 1 | 1 | 1 | 2 | – |
| CO3 | 3 | 1 | 1 | 1 | 2 | – |
| CO4 | 3 | 1 | 1 | 1 | 2 | – |
| CO5 | 3 | 1 | 1 | 1 | 2 | – |

**TEXTBOOK:**

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2016

**REFERENCES:**

1. The Constitution of India,1950(Bare Act),Government Publication.

2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution,1st Edition, 2015.

3. M.P. Jain, Indian Constitution Law, 7th Edn., LexisNexis,2014.

4. D.D. Basu, Introduction to the Constitution of India, LexisNexis, 2015.

ME(CSE)79

| PPCS1AC04 | | நற்றமிழ் இலக்கியம் | L T P C |
|---|---|---|---|
| | | | 2 0 0 0 |
| **COURSE OBJECTIVE** | | | |
| | | | |

**UNIT I சங்க இலக்கியம்**
6

1. தமிழின் துவக்க நூல் தொல்கொப்பியம் – எழுத்து, த ொல், தபொருள்

2. அகநொனூறு (82) - இயற்கக இன்னிக அரங்கம்

3. குறிஞ்சிப் பொட்டின் மலர்க்கொட்சி

4. புறநொனூறு (95,195) - பபொகர நிறுத்திய ஒளகவயொர்

---

**UNIT II அறநநறித்தமிழ**      6

1. அறதநறி வகுத்த திருவள்ளுவர் - அறம் வலியுறுத்தல், அன் புகடகம, ஒப்புறவு அறிதல், ஈகக, புகழ

2. பிற அறநூல்கள் - இலக்கிய மருந்து – ஏலொதி, சிறுபஞ் மூலம், திரிகடுகம், ஆ ொரக்பகொகவ (தூய்கமகய வலியுறுத்தும்நூல் )

---

**UNIT III இரட்டடக் காப்பியங்கள்**      6

1. கண் ணகியின் புரட்சி - சிலப்பதிகொர வழக்குகர கொகத

2. மூகப கவ இலக்கியம் மணிபமகல - சிகறக்பகொட்டம் அறக்பகொட்டமொகிய கொகத

---

**UNIT IV அருள்நநறித்தமிழ**
6

1. சிறுபொணொற்றுப்பகட - பொரி முல்கலக்குத்பதர்தகொடுத்தது, பபகன் மயிலுக்குப் பபொர்கவ தகொடுத்தது, அதியமொன் ஒளகவக்கு தநல்லிக்கனி தகொடுத்தது, அர ர் பண் புகள்

2. நற்றிகண - அன்கனக்குரிய புன்கன சிறப்பு

3. திருமந்திரம் (617, 618) - இயமம் நியமம் விதிகள்

4. தர்ம ஃ ொகலகய நிறுவிய வள்ளலொர்

5. புறநொனூறு - சிறுவபன வள்ளலொனொன்

6. அகநொனூறு (4) - வண் டு நற்றிகண (11) - நண் டு கலித்தொகக (11) - யொகன, புறொ ஐந்திகன 50 (27) - மொன் ஆகியகவ பற்றிய த ய்திகள

---

**UNIT V நவீன தமிழ் இலக்கியம்**
6

1. உகரநகடத்தமிழ்,

- தமிழின் முதல் புதினம், - தமிழின் முதல் சிறுககத, - கட்டுகர இலக்கியம், - பயணஇலக்கியம், - நொடகம்,

2. நொட்டு விடுதகல பபொரொட்டமும் தமிழ் இலக்கியமும்,

3. முதொய விடுதகலயும் தமிழ் இலக்கியமும்,

4. தபண் விடுதகலயும் விளிம்பு நிகலயினரின் பமம்பொட்டில் தமிழ் இலக்கியமும்,

5. அறிவியல் தமிழ்,

 6. இகணயத்தில் தமிழ், 7

. சுற்று சூழல் பமம்பொட்டில் தமிழ் இலக்கியம்.

| | **TOTAL: 30 PERIODS** |
|---|---|

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

| COs | Course Outcomes | Cognitive level |
|---|---|---|
| CO1 | Ability to summarize basics of disaster | Understand |
| CO2 | Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response | Apply |
| CO3 | Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives. | Understand |
| CO4 | Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations. | Understand |
| CO5 | Ability to develop the strengths and weaknesses of disaster management approaches | Analyze |

**CO – PO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 2 | 1 | 1 | – |
| CO2 | 3 | 1 | 1 | 1 | 1 | – |
| CO3 | 3 | 1 | 1 | 1 | 1 | – |
| CO4 | 3 | 1 | 1 | 1 | 2 | – |
| CO5 | 3 | 1 | 1 | 1 | 2 | – |

**TEXTBOOK:**

1. தமிழ் இகணய கல்விக்கழகம் (Tamil Virtual University) - www.tamilvu.org

2. தமிழ் விக்கிப்பீடியொ (Tamil Wikipedia) -https://ta.wikipedia.org

3. தர்மபுர ஆதின தவளியீடு

**REFERENCES:**

1. வொழ்வியல் களஞ்சியம் - தமிழ்ப் பல்ககலக்கழகம், தஞ் ொஞூர்

2. தமிழ்ககலக்களஞ்சியம் - தமிழ் வளர் ஃசித்துகற (thamilvalarchithurai.com)

3. அறிவியல் களஞ்சியம் - தமிழ்ப் பல்ககலக்கழகம், தஞ் ொஞூர

ME(CSE)81