# K.S. Rangasamy College of Technology

**(Autonomous)**

# Curriculum & Syllabus

# of

# M.E. Computer Science and Engineering

**(For the batch 2021 – 2023)**

# R 2018

**Courses Accredited by NBA, Accredited by NAAC,**
**Approved by AICTE, Affiliated to Anna University, Chennai.**

**KSR Kalvi Nagar, Tiruchengode – 637 215.**
**Namakkal District, Tamil Nadu, India.**

**SEMESTER I**

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | 50 PCS 101 | Mathematical Foundation of Computer Science | PC | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 PCS102 | Advanced Data Structures and Algorithms | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 PCS 103 | Advanced Database Technology | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 PCS 104 | Object Oriented Software Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 PCS E1* | Elective I | PE | 3 | 3 | 0 | 0 | 3 |
| 6. | 50 AT 00* | Audit Course | AC | 2 | 2 | 0 | 0 | 0 |
| **PRACTICALS** | | | | | | | | |
| 7. | 50 PCS 1P1 | Advanced Data Structures and Algorithms Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 8. | 50 PCS 1P2 | Advanced Database Technology Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| | | | **Total** | **25** | **17** | **0** | **8** | **19** |

**SEMESTER II**

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | 50 PCS 201 | Big Data Analytics | PC | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 PCS 202 | Soft Computing | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 PCS 203 | Machine Learning Techniques | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 PCS E2* | Elective II | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 PCS E3* | Elective III | PE | 3 | 3 | 0 | 0 | 3 |
| 6. | 50 AT 00* | Audit Course | AC | 2 | 2 | 0 | 0 | 0 |
| **PRACTICALS** | | | | | | | | |
| 7. | 50 PCS 2P1 | Big Data Analytics Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| | | | **Total** | **21** | **17** | **0** | **4** | **17** |

**SEMESTER III**

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | 50 PCS E4* | Elective IV | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 PCS E5* | Elective V | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 PCS E6* | Elective VI | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 AT 009 | Research Ethics | AC | 1 | 1 | 0 | 0 | 0 |
| **PRACTICALS** | | | | | | | | |
| 5. | 50 PCS 3P1 | Dissertation -I/Industrial Project | PC | 20 | 0 | 0 | 20 | 10 |
| | | | **Total** | **29** | **9** | **0** | **20** | **19** |

**SEMESTER IV**

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **PRACTICALS** | | | | | | | | |
| 1. | 50 PCS 4P1 | Dissertation - II | PC | 32 | 0 | 0 | 32 | 16 |
| | | | **Total** | **32** | **0** | **0** | **32** | **16** |

**TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 71**

**Note**:, PC-Professional Core Courses, PE-Professional Elective Courses, EEC-Employability Enhancement Courses & AT- Audit Courses

Rev.No. 4 / w.e.f. 14/03/2022
Passed in BoS Meeting held on 12/02/2022

BoS Chairman

**PROFESSIONAL CORE (PC)**

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 50 PCS 101 | Mathematical Foundation of Computer Science | PC | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 PCS102 | Advanced Data Structures and Algorithms | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 PCS 103 | Advanced Database Technology | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 PCS 104 | Object Oriented Software Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 PCS 1P1 | Advanced Data Structures and Algorithms Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 6. | 50 PCS 1P2 | Advanced Database Technology Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 7. | 50 PCS 201 | Big Data Analytics | PC | 3 | 3 | 0 | 0 | 3 |
| 8. | 50 PCS 202 | Soft Computing | PC | 3 | 3 | 0 | 0 | 3 |
| 9. | 50 PCS 203 | Machine Learning Techniques | PC | 3 | 3 | 0 | 0 | 3 |
| 10. | 50 PCS 2P1 | Big Data Analytics Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 11. | 50 PCS 3P1 | Dissertation -I/Industrial Project | EEC | 20 | 0 | 0 | 20 | 10 |
| 12. | 50 PCS 4P1 | Dissertation - II | EEC | 32 | 0 | 0 | 32 | 16 |

**Elective I**

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 50 PCS E11 | Advanced Computer Architecture | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 PCS E12 | Cloud Computing | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 PCS E13 | Data Warehousing and Data Mining | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 PCS E14 | Distributed Database | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 PCS E15 | Network Security | PE | 3 | 3 | 0 | 0 | 3 |
| | | | **Total** | **15** | **15** | **0** | **0** | **15** |

**Elective II**

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 50 PCS E21 | Data Encryption and Compression | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 PCS E22 | Ethical Hacking | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 PCS E23 | Mobile and Pervasive Computing | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 PCS E24 | Recommender System | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 PCS E25 | Reconfigurable Computing | PE | 3 | 3 | 0 | 0 | 3 |
| | | | **Total** | **15** | **15** | **0** | **0** | **15** |

**Elective III**

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 50 PCS E31 | Data Preparation and Analysis | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 PCS E32 | Protocols and Architecture for Mobile ad-hoc networks | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 PCS E33 | Secure Coding | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 PCS E34 | Software Quality Management | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 PCS E35 | Wireless Sensor Networks | PE | 3 | 3 | 0 | 0 | 3 |
| | | | **Total** | **15** | **15** | **0** | **0** | **15** |

**Elective IV**

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 50 PCS E41 | Biometrics | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 PCS E42 | GPU Computing | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 PCS E43 | Natural Language Processing | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 PCS E44 | Speech Processing and Synthesis | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 PCS E45 | Web Analytics and Development | PE | 3 | 3 | 0 | 0 | 3 |
| | | | **Total** | **15** | **15** | **0** | **0** | **15** |

**Elective V**

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 50 PCS E51 | Human and Computer Interaction | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 PCS E52 | Malware Analysis and Reverse Engineering | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 PCS E53 | Image Processing and Analysis | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 PCS E54 | Social Network Analysis | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 PCS E55 | Web Data Mining | PE | 3 | 3 | 0 | 0 | 3 |
| | | | **Total** | **15** | **15** | **0** | **0** | **15** |

**Elective VI**

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 50 PCS E61 | Software Quality Assurance and Testing | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | 50 PCS E62 | Smart Sensors and Internet of Things | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | 50 PCS E63 | Formal Models of Software Systems | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | 50 PCS E64 | Performance Analysis of Computer Systems | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | 50 PCS E65 | Language Technologies | PE | 3 | 3 | 0 | 0 | 3 |
| | | | **Total** | **15** | **15** | **0** | **0** | **15** |

**SEMESTER I, SEMESTER II & SEMESTER III, AUDIT COURSES (AT)**

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 50 AT 001 | English for Research Paper Writing | AT | 2 | 2 | 0 | 0 | 0 |
| 2. | 50 AT 002 | Disaster Management | AT | 2 | 2 | 0 | 0 | 0 |
| 3. | 50 AT 003 | Sanskrit for Technical Knowledge | AT | 2 | 2 | 0 | 0 | 0 |
| 4. | 50 AT 004 | Value Education | AT | 2 | 2 | 0 | 0 | 0 |
| 5. | 50 AT 005 | Pedagogy Studies | AT | 2 | 2 | 0 | 0 | 0 |
| 6. | 50 AT 006 | Stress Management by Yoga | AT | 2 | 2 | 0 | 0 | 0 |
| 7. | 50 AT 007 | Personality Development through Life Enlightenment Skills | AT | 2 | 2 | 0 | 0 | 0 |
| 8. | 50 AT 008 | Constitution of India | AT | 2 | 2 | 0 | 0 | 0 |
| 9. | 50 AT 009 | Research Ethics | AT | 1 | 1 | 0 | 0 | 0 |

## EMPLOYABILITY ENHANCEMENT COURSES (EEC)

| S. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 50 PCS 3P1 | Dissertation -I/Industrial Project | EEC | 20 | 0 | 0 | 20 | 10 |
| 2. | 50 PCS 4P1 | Dissertation - II | EEC | 32 | 0 | 0 | 32 | 16 |

### SUMMARY

| S.No. | Category | Credits Per Semester | | | | Total Credits | Percentage % |
|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | | |
| | PC | 16 | 11 | - | - | **27** | **38.03** |
| | PE | 3 | 6 | 9 | - | **18** | **25.35** |
| | EEC | - | - | 10 | 16 | **26** | **36.62** |
| | AT | 0 | 0 | - | - | **0** | **0** |
| Total | | **19** | **17** | **19** | **16** | **71** | **100** |

| K.S.Rangasamy College of Technology - Autonomous Regulation | | | | | | | | R 2018 |
|---|---|---|---|---|---|---|---|---|
| Department | Computer Science and Engineering | | Programme Code & Name | | M.E. Computer Science and Engineering | | | |
| Semester I | | | | | | | | |
| Course Code | Course Name | Hours/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| 50 PCS 101 | **Mathematical Foundation of Computer Science** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |

| | |
|---|---|
| Objective(s) | • To develop the skills of the students in the fields of theory of estimation.<br>• To familiarize number theory and its applications.<br>• To widen knowledge about basics of formal languages and automata theory.<br>• To understand the concept of transportation and assignment models.<br>• To learn the concept of scheduling by PERT and CPM. |
| Course Outcomes | 1. Understand the fundamentals of theory of estimation.<br>2. Apply the basic properties of number theory.<br>3. Identify the language in deterministic and non-deterministic finite state automation.<br>4. Employ the different techniques for solving transportation and assignment models.<br>5. Apply PERT/CPM methods to evaluate the core tasks within complicated operations. |

| | |
|---|---|
| 1 | THEORY OF ESTIMATION |
| Estimation theory: Point estimation – unbiased estimator – consistency estimator – efficiency estimator and sufficiency estimator – Method of point estimation – Method of Maximum Likelihood - Method of Moments– Interval estimation - Confidence intervals. [9] | |
| 2 | NUMBER THEORY |
| Divisibility – Prime Numbers –Fundamental theorem of Arithmetic – The Sieve of Eratosthenes – Division Procedure – Greatest Common Division – Alternative Definition of GCD - Least Common Multiple – Congruence – Congruence Class Modulo m – Linear Congruence - The Chinese Remainder Theorem. [9] | |
| 3 | FORMAL LANGUAGES AND AUTOMATA THEORY |
| Finite state machines–Deterministic and Non-deterministic finite state machines–Turing Machines–Formal Languages–Classes of Grammars–Type 0–Context Sensitive–Context Free–Regular Grammars–Ambiguity [9] | |
| 4 | TRANSPORTATION AND ASSIGNMENT MODELS |
| Mathematical formulation of transportation problem – Methods for finding initial basic feasible solution – Optimal solution – Degeneracy – Mathematical formulation of Assignment models – Hungarian algorithm – The Travelling Salesman Problem. [9] | |
| 5 | SCHEDULING BY PERT AND CPM |
| Network construction – Critical path method – Project Evaluation and Review Technique – Resource Analysis in Network Scheduling. [9] | |
| Total hours to be taught | 45 |

| | |
|---|---|
| Text book (s) : | |
| 1. | Veerarajan T., “Discrete Mathematics with Graph Theory and Combinatorics“ TataMcGraw-Hill, Eighth Reprint 2009. |
| 2. | KantiSwarup, Gupta P.K., Man Mohan, “Operations Research”, Sultan Chand and Sons. |
| Reference(s): | |
| 1. | Kapur J.N. and Saxena H.C., “Mathematical Statistics” ,S.Chand& Company Ltd., New Delhi, 2003. |
| 2. | Gupta.S.C. “Fundamentals of Statistics” Himalaya Publishing House, Mumbai,Reprint 2011. |
| 3. | Arora P.N. and Arora S, “Statistics for Management”, S.Chand& Company Ltd., New Delhi, 2003. |
| 4. | Kenneth H Rosen, “Discrete Mathematics and its Applications”, McGraw Hill Education (India) Pvt. Ltd, New Delhi, 2007. |

| K.S. Rangasamy College of Technology – Autonomous R2018 | | | |
|---|---|---|---|
| Department | Computer Science and Engineering | Programme Code & Name | PCS: M.E. Computer Science and Engineering |

Semester I

| Course Code | Course Name | Hours/Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CA | ES | Total |
| **50 PCS 102** | **Advanced Data Structures and Algorithms** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |

| | |
|---|---|
| Objective(s) | • To choose appropriate data structures and design algorithms for a specific problem.<br>• To obtain algorithm analysis skills<br>• To design efficient algorithms.<br>• To learn advanced paradigms and data structures used to solve problems.<br>• To study applications of algorithms in different areas, including string matching, sorting, information retrieval, geometry and numerals. |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Understand multi-dimensional arrays and use algorithm analysis skills.<br>2. Illustrate the operations of heap structures<br>3. Apply digital search trees and solve problems using different types of tries<br>4. Summarize various multimedia structures and its applications<br>5. Describe the use of geometric and numeric algorithms to solve real-life problems |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Fundamentals**

Mathematical Induction-Asymptotic Notations–Properties of Big-oh Notation–Conditional Asymptotic Notation–Algorithm Analysis–Amortized Analysis–NP Completeness–NP-Hard–Recurrence Equations–Solving Recurrence Equations–Memory Representation of Multi-dimensional Arrays–Time-Space Tradeoff. [9]

**Heap Structures**

Min/Max heaps–Deaps–Leftist Heaps–Binomial Heaps–Fibonacci Heaps–Skew Heaps–Lazy-Binomial Heaps [9]

**Digital Search Structures**

Digital Search Trees-Binary Tries and Patricia-Multiway Tries-Suffix Trees-Tries and Internet Packet Forwarding. [9]

**Multimedia Structures**

Segment Trees–k-d Trees–Point Quad Trees–MX-Quad Trees–R-Trees–TV Trees. [9]

**Algorithms**

Convex Hull–Tree Vertex Splitting–Activity Networks–Flow Shop Scheduling–Counting Binary Trees–Introduction to Randomized Algorithms-The Fast Fourier Transform. [9]

**Total Hours: 45**

Text book (s) :


| | |
|---|---|
| 1 | Horowitz.E.,Sahni.S. and Dinesh Mehta, Fundamentals of Data structures in C++, University Press, 2007. |
| 2 | Peter Brass, “Advanced Data Structures”, Cambridge University Press, 2008 |


Reference(s):


| | |
|---|---|
| 1 | E. Horowitz, S. Sahni and S. Rajasekaran, Computer Algorithms/C++, Second Edition, University Press, 2007. |
| 2 | BrassardG. and BratleyP., Algorithmics: Theory and Practice, Prentice–Hall, 1988. |
| 3 | Subramanian.V.S., Principles of Multimedia Database systems, Morgan Kaufman, 1998. |
| 4 | Robert Sedgewick and Kevin Wayne, “Algorithms”, Fourth Edition, Addison-Wesley |

| K.S. Rangasamy College of Technology – Autonomous R2018 | | | |
|---|---|---|---|
| Department | Computer Science and Engineering | Program code & Name | PCS: M.E. Computer Science and Engineering |

Semester I

| Course Code | Course Name | Hours/Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CA | ES | Total |
| **50 PCS 103** | **Advanced Database Technology** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |

| | |
|---|---|
| Objective(s) | • To understand the database system concept.<br>• To learn the concepts of relational databases and its applications.<br>• To acquire Knowledge on distributed data bases and its applications.<br>• To learn the concepts of object relational databases.<br>• To understand the concept of XML databases. |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Recognize the basics of database system concepts and data models.<br>2. Examine the relational database system design.<br>3. Outline the distributed databases, client server databases and parallel databases.<br>4. Learn the object and object relational databases.<br>5. Obtain the knowledge of XML databases and data ware housing. |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Data Base System Concept**

File systems - Database systems - Database systems architecture - Data models - Relational model – Hierarchical model - Network model - Entity-Relationship model - Data Dictionary - Database Administration and control. [9]

**Relational Database System Design**

Domains and key concept - Integrity rules - Relational Algebra - Commercial query languages - Embedded SQL - Normalization and database design. File and storage structures - Indexing and Hashing - Query processing. [9]

**Distributed Databases**

Centralized Versus Distributed Databases – Fragmentation – Distributed database architecture – Client / Server databases – Distributed transactions – Locking and Commit protocols – Distributed concurrency Control – Security and reliability – Parallel databases [9]

**Object and Object Relational Databases**

Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended Relational Systems: Object Relational features in SQL/Oracle – Case Studies. [9]

**XML Databases**

XML Databases: XML Data Model – DTD - XML Schema - XML Querying – Web Databases – JDBC – Information Retrieval – Datamining – Datawarehousing. [9]

**Total Hours: 45**

Text book (s) :


| | |
|---|---|
| 1 | Elmasri R. Navathe S.B., “Fundamentals of Database Systems”, Fifth Edition, Pearson Education/Addison Wesley, 2007. |
| 2 | Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Fifth Edition, McGraw Hill, 2006. |


Reference(s) :


| | |
|---|---|
| 1 | SubramanianV.S., “Principles of Multimedia Database Systems”, Harcourt India Pvt Ltd., 2001. |
| 2 | Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Third Edition, Pearson Education, 2007. |
| 3 | Raghu Ramakrishnan and Johannes Gehrke, “Database Management Systems”, Third Edition, McGraw Hill, 2003 |
| 4 | Oracle Database 11g SQL and PL/SQL: A Brief Primer |

| K.S. Rangasamy College of Technology – Autonomous R2018 | | | |
|---|---|---|---|
| Department | Computer Science and Engineering | Programme Code & Name | PCS: M.E. Computer Science and Engineering |

Semester I

| Course Code | Course Name | Hours/Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CA | ES | Total |
| **50 PCS 104** | **Object Oriented Software Engineering** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |

| | |
|---|---|
| Course Objective(s) | • To learn the basics of object oriented software engineering ,modelling and project communications<br>• To acquire the knowledge of requirement and analysis<br>• To learn the basics of system design and object design<br>• To acquire the knowledge of testing and rationale management<br>• To learn the basics of software configuration management and project management |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Learn the basics of object oriented software engineering ,modelling and project communications<br>2. Gain the knowledge of requirement and analysis<br>3. Understand the system design and object design<br>4. Acquire the knowledge of testing and rationale management<br>5. Learn the basics of software configuration management and project management |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Introduction**

Software Engineering: Software related problems, software engineering, concepts, development activities. Modeling: Modeling with UML. Project Communications: Project communication, modes, mechanisms and activities [9]

**Requirement and Analysis**

Requirements: Requirements elicitation, concepts, activities & managing requirements elicitation. Analysis: Analysis overview, concepts, activities and managing analysis [9]

**Design**

System Design: Design overview, concepts, activities and managing system design. Object Design: Object design overview, concepts, activities and managing object design. [9]

**Testing**

Testing: Testing overview, concepts, activities and managing testing. Rationale Management: Rationale overview, concepts, activities and managing rationale. [9]

**Management**

Software Configuration Management: Configuration Management overview, concepts, activities and managing configuration management. Project Management: Project management overview, concepts, activities and managing project management models and activities. [9]

**Total Hours: 45**

Text book(s) :

| | |
|---|---|
| 1 | Bernd Bruegge, Allen H., “Object-Oriented Software Engineering: Using UML, Patterns and Java”, Pearson Education,3/E |
| 2 | Timothy C. Lethbridge and Robert Laganiere, “Object-Oriented Software Engineering: Practical software development using UML and Java”, McGraw-Hill Higher education |

Reference Book(s):

| | |
|---|---|
| 1 | Ivar Jacobson, “Object-oriented Software Engineering: A Use Case Driven Approach”, Seventh Impression, Pearson Education, 2009 |
| 2 | David Kung, “Object-Oriented Software Engineering: An Agile Unified Methodology”, Indian Edition, McGraw-Hill Higher education |
| 3 | Ruchika Malhotra and Yogesh Singh, “Object-oriented software engineering”, PHI Learning Private Limited,2012 |
| 4 | Martin Fowler, “UML distilled: A Brief Guide to the Standard Object Modelling Language”, Third Edition, AddisonWesley. |

| K.S. Rangasamy College of Technology – Autonomous R2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | Computer Science and Engineering | Program code & Name | | | PCS: M.E. Computer Science and Engineering | | | |
| Semester I | | | | | | | | |
| Course Code | Course Name | Hours/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS 1P1** | **Advanced Data Structures and Algorithms Laboratory** | 0 | 0 | 4 | 2 | 60 | 40 | 100 |
| Objective(s) | • To demonstrate multidimensional matrices<br>• To design and implement various heap structures<br>• To develop applications of tries data structures<br>• To perform various multimedia structures<br>• To implement graph algorithm | | | | | | | |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Implement Array Based Representation of Multidimensional Matrices using C++<br>2. Perform operations of heap structures using C++<br>3. Demonstrate the applications of tries using C++<br>4. Implement multimedia structures using C++<br>5. Implement convex hull algorithm using C++ | | | | | | | |

List of Experiments

1. Implementation of multi-dimensional structures such as matrices, triangular matrices, diagonal matrices, etc into a one dimensional array (atleast any two)

2. Implementation of any two of the following Heap structures
Deaps (Insertion, Delete Min, Delete Max)
Leftist Heap (All Meldable Priority Queue operations)
Skew Heap (All Meldable Priority Queue operations)
Fibonacci Heap (All Meldable Priority Queue operations)

3. Implementation of any two of the following Search Structures
AVL Trees (Insertion, Deletion and Search)
Splay Trees (Insertion, Deletion and Search)
Tries for any specified alphabet (Insertion, Deletion and Search)
B-Trees (Insertion, Deletion and Search)

4. Implementation of any two of the following multimedia structures
2-d Trees (Insertion, Deletion and Range Queries)
Point Quad-Trees (Insertion, Deletion and Range Queries)
Segment Trees (Insertion, Deletion – Show list of nodes where in insertion and deletion took place)s

5. Finding Convex-hull.

| K.S. Rangasamy College of Technology – Autonomous R2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | Computer Science and Engineering | Program code & Name | | | PCS: M.E. Computer Science and Engineering | | | |
| Semester I | | | | | | | | |
| Course Code | Course Name | Hours/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS 1P2** | **Advanced Database Technology Laboratory** | 0 | 0 | 4 | 2 | 60 | 40 | 100 |
| Objective(s) | • To use SQL commands and implement the concepts of Normalization<br>• To enable the students to apply the concepts of cursors, triggers, and Dynamic SQL<br>• To apply the knowledge of Inventory Control System and package for a banking domain using C programming<br>• To implement the concepts of office automation and library information system<br>• To implement banking application using XML | | | | | | | |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Develop all SQL commands and concepts of Normalization<br>2. Implement the concepts of cursors, triggers and dynamic SQL<br>3. Implement a program to manage inventory control system<br>4. Develop a package for bank customer details, office automation, and library information system<br>5. Demonstrate program for banking application using XML and DTD creation for library stock maintenance | | | | | | | |

List of Experiments

1. Implement the Study of all SQL commands.
2. Implement the concept of Normalization using first and second normal form.
3. Implement the concept of cursors and Triggers.
4. Implement the concept of Dynamic SQL.
5. Implement the inventory control system with a reorder level.
6. Develop a package for a bank to maintain its customer details.
7. Develop a package for the payroll of a company.
8. Develop an Office Automation package.
9. Design and implementation of Library Information System.
10. Simple structure creation for banking application using XML.
11. DTD creation for library stock maintenance.

| K.S. Rangasamy College of Technology – Autonomous R2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | Computer Science and Engineering | Programme Code & Name | | | PCS : M.E. Computer Science and Engineering | | | |
| Semester II | | | | | | | | |
| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS 201** | **Big Data Analytics** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |
| Objective(s) | • To understand the various algorithms for handling big data<br>• To understand the techniques for handling big data<br>• To learn real time analytics and search<br>• To learn indexing concepts for text retrieval<br>• To gain knowledge on stream computing | | | | | | | |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Understand how to leverage the insights from big data analytics through various algorithms<br>2. Analyze data by utilizing various statistical and data mining approaches<br>3. Perform analytics on real time data using Hadoop related tools<br>4. Comprehend the various indexing methods for text retrieval in big data<br>5. Analyze the concepts of real time data streaming | | | | | | | |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Algorithms for Handling Big Data**

Random Forest Algorithm, Unstructured Data Analytics, Overkill Algorithm-Randomized Matrix Algorithms in Parallel and Distributed Environments, Mahout: Probabilistic Hashing for Efficient Search and Learning on Massive Data Dirichlet process clustering, Latent Dirichlet Allocation, Singular value decomposition, Parallel Frequent Pattern mining, Complementary Naive Bayes classifier, Random forest decision tree based classifier. [9]

**Techniques for Handling Big Data**

Topographic Analysis, Large Scale Machine Learning for Query Document Matching in Web Search-A Geometric Analysis of Subspace Clustering with Outliers Scalable K-Means++,Distrubed Computing- queues-Tools: Hazelcast Architecture, Cross platform, Google Protocol Buffer. [9]

**Real Time Analytics and Search**

In-line queries-In-memory data, data on HDFS, HBase or any other structure on Hadoop clusters. Impala with large scale search engine like Solr Cloud. Real-Time Queries in Hadoop [9]

**Indexing for Text Retrieval**

Inverted Indexing for Text Retrieval- Web Crawling- Inverted - Inverted Indexing: Baseline Implementation - Inverted Indexing: Revised Implementation-Inverted Indexing using JAQL- Index Compression. [9]

**Analytics for Big Data In Motion**

Data Stream Warehousing, Infosphere Stream Basics- How stream works-Streams Processing Language-Stream Tool Kits. Case Studies Big Data in E-Commerce Social and Health Science. [9]

**Total Hours: 45**

Text Book(s):


| | |
|---|---|
| 1 | Paul C. Zikopoulos, Chris Eaton, Dirk deRoos, Thomas Deutsch, George Lapis, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data,McGraw-Hill, 2012. |
| 2 | Lin and Chris Dyer,”Data-Intensive Text Processing with MapReduce Jimmy”, Morgan & Claypool Synthesis, 2010. |


Reference Book(s):


| | |
|---|---|
| 1 | Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & Sons, 2012. |
| 2 | Donald Miner and Adam Shook, “MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems”, 1st edition, O'Reilly Media, 2017. |
| 3 | Jure Leskovec**,** Anand Rajaraman, Jeffrey D. Ullman, ”Mining of Massive Datasets”, Second Edition, Dreamtech Press, 2016**.** |
| 4 | Philipp K. Janert, “Data Analysis with Open Source Tools: A Hands-On Guide for Programmers and Data Scientist”, 1st Edition, O'Reilly Media, 2010. |

| K.S. Rangasamy College of Technology – Autonomous R2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | Computer Science and Engineering | | | Programme Code & Name | | PCS: M.E. Computer Science and Engineering | | |
| Semester II | | | | | | | | |
| Course Code | Course Name | Hours/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS 202** | **Soft Computing** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |

| | |
|---|---|
| Objective(s) | • To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario<br>• To implement soft computing based solutions for real-world problems<br>• To introduce the fuzzy systems, fuzzy logic, genetic algorithms and its applications.<br>• To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks.<br>• To provide student a hand-on experience on MATLAB to implement various strategies |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Identify and describe soft computing techniques and their roles in building intelligent machines<br>2. Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems<br>3. Apply genetic algorithms to combinatorial optimization problems<br>4. Evaluate and compare solutions by various soft computing approaches for a given problem<br>5. Apply the knowledge of soft computing techniques in artificial neural networks and fuzzy logic |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Introduction to Soft Computing and Neural Networks**

Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics [9]

**Fuzzy Logic**

Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making. [9]

**Neural Networks**

Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks , Recurrent neural networks [9]

**Genetic Algorithms**

Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition. [8]

**Python Lib**

Introduction to Python, Arrays and array operations, Functions and Files

**Recent Trends**

Recent Trands in deep learning, various classifiers, neural networks and genetic algorithm.
Implementation of recently proposed soft computing techniques. [10]

**Total Hours: 45**

Text Book(s):

| | |
|---|---|
| 1 | Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, “Neuro:Fuzzy and Soft Computing”, Prentice:Hall of India, 2003. |
| 2 | George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic:Theory and Applications”, Prentice Hall, 1995. |

Reference Book(s):

| | |
|---|---|
| 1 | D. K. Pratihar, “Soft Computing: Fundamentals and Applications”, Alpha Science International Ltd, 2013 |
| 2 | Samir Roy, Udit Chakraborty, “Introduction to Soft Computing - Neuro – Fuzzy and Genetic Algorithms”, First Edition, Pearson. |
| 3 | N.P. Padhy, S.P. Simon, “Soft Computing with MATLAB Programming”, First Edition, Oxford Higher Education, 2015. |
| 4 | MATLAB Toolkit Manual. |

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|---|---|---|---|---|---|---|---|---|---|
| Department | Computer Science and Engineering | | Programme Code & Name | | | PCS: M.E. Computer Science and Engineering | | | |
| Semester II | | | | | | | | | |
| Course Code | Course Name | Hours/Week | | | | Credit | Maximum Marks | | |
| | | L | T | P | | C | CA | ES | Total |
| **50 PCS 203** | **Machine Learning Techniques** | 3 | 0 | 0 | | 3 | 50 | 50 | 100 |
| Objective(s) | • To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes<br>• To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances<br>• Explore supervised and unsupervised learning paradigms of machine learning<br>• To explore Deep learning techniques<br>• To analyze various feature extraction strategies | | | | | | | | |
| Course Outcomes | **At the end of the course the student will be able to**<br>• Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.<br>• Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning<br>• To learn function and allows you to estimate how accurate the model's outputs are, on average. The entire machine learning framework boils down to optimizing this function<br>• Able to identify the underlying statistical and algorithmic principles required to develop scalable real-world machine learning<br>• Be able to design and implement various machine learning algorithms in a range of real- world applications | | | | | | | | |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Supervised Learning (Regression/Classification)** Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes, Linear models: Linear Regression, Logistic Regression, Generalized Linear Models. Support Vector Machines, Nonlinearity and Kernel Methods, Beyond Binary Classification: Multi-class/Structured Outputs, Ranking, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests) [9]

**Unsupervised Learning**

Clustering: K-means/Kernel K-means, Dimensionality Reduction: PCA and kernel PCA, Matrix Factorization and Matrix Completion, Confusion Matrix, Generative Models (mixture models and latent factor models) Evaluating Machine Learning algorithms and Model Selection, [10]

**Modeling and Estimation**

Sparse Modeling, Modeling Sequence/Time-Series Data, Data Wrangling, Deep Learning and Feature Representation Learning [8]

**Scalable Machine Learning**

Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference [9]

**Recent Trends**

Various learning techniques of machine learning and classification methods for IOT applications. Various models for IOT applications. [9]

**Total Hours: 45**

Text Book(s):

| | |
|---|---|
| 1 | Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012 |
| 2 | *Mohssen Mohammed, Muhammad Badruddin Khan, Eihab Bashier Mohammed Bashier* , "Machine Learning Algorithms and Applications", 1st Edition, CRC Press, 2016. |

Reference Book(s):

| | |
|---|---|
| 1 | Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007. |
| 2 | Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online). |
| 3 | Tom M. Mitchell, “Machine Learning”, Ist Edition, McGraw Hill, 1997. |
| 4 | Drew Conway and John Myles White, “Machine Learning for Hackers: Case Studies and Algorithms to Get you Started”, First Edition, O’Reilly Media, 2012. |

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|---|---|---|---|---|---|---|---|---|
| Department | Computer Science and Engineering | Programme Code & Name | | | PCS : M.E. Computer Science and Engineering | | | |
| Semester II | | | | | | | | |
| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS 2P1** | **Big Data Analytics Laboratory** | 0 | 0 | 4 | 2 | 60 | 40 | 100 |
| Objective(s) | • To implement standard algorithms and using standard tools for analyzing data sets<br>• To understand Topographic Analysis for handling Data Analytics<br>• To learn Machine Learning concepts in web search<br>• To gain knowledge in real time data analytics<br>• To learn the concepts of big data analytics in motion | | | | | | | |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Gain knowledge in implementation of various algorithms<br>2. Implement topographic analysis for handling big data<br>3. Implement machine learning in web search<br>4. Implement real time analytics using Hadoop, SolrCloud, Cloudera Impala<br>5. Implement big data analytics for streaming / motion related applications | | | | | | | |
| List of Experiments | | | | | | | | |
| 1. Implementation of Random Forest Algorithm for Handling Large Data sets<br>2. Implementation of Overkill Algorithm for Handling Large Data Sets<br>3. Implementing Topographic Analysis for handling Data Analytics<br>4. Large Scale Machine Learning for Query Document Matching in Web Search<br>5. Real Time Analytics and Search using Hadoop and SolrCloud<br>6. Real Time Analytics and Search using Cloudera Impala<br>7. Indexing for Text Retrieval<br>8. Analytics for Big Data in Motion using Energy Consumption data sets<br>9. Analytics for Big Data in Motion using Social and Health Science data sets | | | | | | | | |

<table>
<tr><th colspan="8">K.S.Rangasamy College of Technology – Autonomous R 2018</th></tr>
<tr><th colspan="8">50 PCS 3P1 Dissertation -I/Industrial Project</th></tr>
<tr><td rowspan="2">Semester</td><td colspan="3">Hours / Week</td><td rowspan="2">Total hrs</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CA</td><td>ES</td><td>Total</td></tr>
<tr><td>III</td><td>0</td><td>0</td><td>20</td><td>60</td><td>10</td><td>100</td><td>00</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">• To import the practical knowledge to the students and also to make them to carry out the technical procedures in their project work.<br>• To provide an exposure to the students to refer, read and review the research articles, journals and conference proceedings relevant to their project work and placing this as their beginning stage for their final presentation.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">At the end of the course, the students will be able to<br>1. Survey the relevant literature such as books, national/international refereed journals and contact resource persons for the selected topic of research.<br>2. Use different experimental techniques/different software/ computational/analytical tools.<br>3. Design and develop an experimental set up/ equipment/test rig.<br>4. Conduct tests on existing set ups/equipment and draw logical conclusions from the results after analyzing them.<br>5. Work in a research environment or in an industrial environment.</td></tr>
<tr><td colspan="8">The Project Work will start in semester III and should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. Seminar should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches of M.E/M. Tech. The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report. The work has to be presented in front of the examiners panel set by Head and PG coordinator. The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student.</td></tr>
</table>

| K.S.Rangasamy College of Technology – Autonomous R 2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 PCS 4P1 – Dissertation – II** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| IV | 0 | 0 | 32 | 60 | 16 | 50 | 50 | 100 |
| **Objective(s)** | • This enables and strengthens the students to carry out the project on their own and to implement their innovative ideas to forefront the risk issues and to retrieve the hazards by adopting suitable assessment methodologies and staring it to global. | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>1. Develop attitude of lifelong learning and will develop interpersonal skills to deal with people working in diversified field will.<br>2. Write technical reports and research papers to publish at national and international level.<br>3. Develop strong communication skills to defend their work in front of technically qualified audience. | | | | | | | |
| It is a continuation of Project work started in semester III. He has to submit the report in prescribed format and also present a seminar. The dissertation should be presented in standard format as provided by the department. The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion. The report must bring out the conclusions of the work and future scope for the study. . The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner and a guide, co-guide etc. as decided by the Head and PG coordinator. The candidate has to be in regular contact with his guide. | | | | | | | | |

| K.S. Rangasamy College of Technology – Autonomous R2018 | | | |
|---|---|---|---|
| Department | Computer Science and Engineering | Programme Code & Name | PCS: M.E. Computer Science and Engineering |

Elective I

| Course Code | Course Name | Hours/Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E11** | **Advanced Computer Architecture** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |

**Objective(s)**

- To analyze various performance related parameters in computer architecture and understand instruction set architectures
- To understand Instruction Level Parallelism(ILP) with its limitations
- To utilize the ILP concept for memory design
- To review various issues in multiprocessor
- To understand the design of the memory hierarchy and analyze the types of multiprocessors

**Course Outcomes**

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

1. Understand performance related parameters and the concepts of Instruction Set architectures
2. Describe Instruction Level parallelism and identify the limitations of ILP
3. Discuss the approaches of exposing and exploiting ILP
4. Design hierarchical memory System
5. Analyze the types of multiprocessor architecture and storage devices

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Fundamentals of Computer Design**

Introduction-measuring and reporting performance- Quantitative principles of computer design-Instruction set principles and examples- classifying instructions- set architectures-memory addressing-addressing modes for signal processing-type and size of operands. [9]

**Instruction Level Parallelism**

Concepts and challenges – overcoming data hazards with dynamic scheduling – examples- reducing branch costs with dynamic hardware prediction- high performance instruction delivery- taking advantages of ILP with multiple issues-limitations of ILP. [9]

**ILP with Software Approaches**

Basic compiler techniques for exposing ILP- static branch prediction- static multiple issues: VLIW approach- Advanced compiler support for exposing and exploiting ILP-Hardware support-cross cutting issues- Intel IA64 architecture. [9]

**Memory Hierarchy Design**

Introduction- review of caches- cache performance- reducing cache miss penalty-reducing miss rate- miss rate via parallelism –reducing hit time – main memory and organizations for improving performance- memory technology- virtual memory. [9]

**Multiprocessors and Thread Level Parallelism**

Symmetric shared memory architectures-performance of symmetric shared memory multiprocessors – Distributed shared memory architectures-synchronization- storage systems – types of storage devices- buses-reliability-availability and dependability- RAID – errors and failures in real systems- I/O performance measures-Introduction to queuing theory. [9]

**Total Hours: 45**

Text book (s) :


| | |
|---|---|
| 1 | John L. Hennessy and David A. Patterson," Computer Architecture: A Quantitative Approach", Morgan Kaufmann, 3rd Edition 2003. |
| 2 | Michael J.Flynn, "Computer Architecture, Pipelined and Parallel Processor Design", Jones and Bartlett Publishers, Inc. |


Reference Book(s):


| | |
|---|---|
| 1 | Sima D. FountainT. andKacsukP., "Advanced Computer Architectures: A Design Space Approach", Addison Wesley, 2000. |
| 2 | Kai Hwang "Advanced Computer Architecture: Parallelism, Scalability,Programmability" Tata McGraw Hill Edition, 2001. |
| 3 | Harold S Stone, "High Performance Computer Architecture", Third Edition, Addison Wesley. |
| 4 | David A. Patterson and John L. Hennessy "Computer Organization and Design, The Hardware/Software Interface: RISC-V Edition " MK Publishers, 2018 |

| K.S. Rangasamy College of Technology – Autonomous R2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | Computer Science and Engineering | | Programme Code & Name | | | PCS : M.E. Computer Science and Engineering | | |
| Elective I | | | | | | | | |
| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E12** | **Cloud Computing** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |
| Objective(s) | • To learn the fundamentals of cloud computing<br>• To visualizes the cloud benefits and services,<br>• To give the insights for cloud as a virtualization strategy,<br>• To deals with different cloud model layers, different types of cloud offering and cloud system management.<br>• To understand the concept of Map-Reduce Programming and various Cloud Applications | | | | | | | |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Identify the key dimensions, architecture, infrastructure and delivery models of cloud computing<br>2. Understanding the Principles of Parallel and Distributed Computing<br>3. Apply the concept of virtualization in the cloud computing.<br>4. Build and deploy customized applications on cloud using Aneka Cloud Application Development Platform<br>5. Understand the concept of Map-Reduce Programming and various Cloud Applications | | | | | | | |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Introduction**

Cloud Computing at a Glance: The Vision of Cloud Computing-Defining a Cloud -A Closer Look - Cloud Computing Reference Model-Characteristics and Benefits -Challenges Ahead-Historical Developments: Distributed Systems-Virtualization-Web-Service-Oriented Computing-Utility-Oriented Computing-Building Cloud Computing Environments: Application Development-Infrastructure and System Development-Computing Platforms and Technologies: Amazon Web Services (AWS) -Google AppEngine-Microsoft Azure- Hadoop-Force.com and Salesforce.com -Manjrasoft Aneka. [9]

**Principles of Parallel and Distributed Computing**

Eras of Computing-Parallel vs. Distributed Computing-Elements of Parallel Computing: What is Parallel Processing?-Hardware Architectures for Parallel Processing Approaches to Parallel Programming- Levels of Parallelism**-**Laws of Caution- Elements of Distributed Computing: General Concepts and Definitions - Components of a Distributed System - Architectural Styles for Distributed Computing. [9]

**Virtualization and Cloud Computing Architecture**

Introduction -Characteristics of Virtualized Environments -Taxonomy of Virtualization Techniques: Execution Virtualization -Other Types of Virtualization-Virtualization and Cloud Computing-Pros and Cons of Virtualization-Technology Examples -Xen: Para virtualization -VMware: Full Virtualization - Microsoft Hyper-V - Cloud Computing Architecture: Introduction -Cloud Reference Model –Architecture-Infrastructure / Hardware as a Service-Platform as a Service -Software as a Service -Types of Clouds: Public Clouds -Private Clouds-Hybrid Clouds -Community Clouds -Economics of the Cloud- Open Challenges -Cloud Definition -Cloud Interoperability and Standards -Scalability and Fault Tolerance -Security, Trust, and Privacy -Organizational Aspects. [9]

**Aneka: Cloud Application Platform**

Framework Overview -Anatomy of the Aneka Container-From the Ground Up: Platform Abstraction Layer - Fabric Services-Foundation Services -Application Services Building Aneka Clouds: Infrastructure Organization - Logical Organization-Private Cloud Deployment Mode -Public Cloud Deployment Mode-Hybrid Cloud Deployment Mode-Cloud Programming and Management -Aneka SDK - Management Tools. [8]

**Data Intensive Computing: Map-Reduce Programming and Cloud Applications**

Data Intensive Computing: What is Data-Intensive Computing-Characterizing Data-Intensive Computations-Challenges Ahead -Historical Perspective -Technologies for Data-Intensive Computing: Storage Systems-Programming Platforms- Aneka MapReduce Programming -Introducing the MapReduce Programming Model-Example Application

Cloud Applications: Scientific Applications-Healthcare: ECG Analysis in the Cloud-Biology: Protein Structure Prediction -Biology: Gene Expression Data Analysis for Cancer Diagnosis- Geoscience: Satellite Image Processing-Business and Consumer Applications: CRM and ERP-Productivity-Social Networking-Media Applications- Multiplayer Online Gaming. [10]

**Total Hours: 45**

| Text Book: | |
|---|---|
| 1. | Rajkumar Buyya,“ Mastering Cloud Computing” The University of Melbourne and Manjrasoft Pvt Ltd,Melbourne, Australia. |
| 2. | Rajkumar Buyya, Andrzej Goscinski, James Broberg, “Cloud Computing: Principles and Paradigms”, Wiley, 2010. |
| Reference (s) : | |
| 1 | Thomas Erl, Ricardo Puttini, Zaigham Mahmood, “Cloud Computing: Concepts, Technology & Architecture”, Prentice Hall, 2013. |
| 2 | Michael Kavis, “Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)” Wiley, 2014. |
| 3 | D. Casal, “Cloud Computing for Programmers: Software Development in the Age of Cloud”, Daniele Casal, 2014 |
| 4 | Arshdeep Bahga, Vijay Madisetti, “Cloud Computing: A Hands-On Approach”, Vijay Madisetti, 2014. |

| K.S. Rangasamy College of Technology – Autonomous R2018 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Department | Computer Science and Engineering | Programme Code & Name | | | PCS: M.E. Computer Science and Engineering | | | | |
| **Elective I** | | | | | | | | | |
| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | | |
| | | L | T | P | C | CA | ES | Total | |
| **50 PCS E13** | **Data Warehousing and Data Mining** | 3 | 0 | 0 | 3 | 50 | 50 | 100 | |

| | |
|---|---|
| Objective(s) | • To understand the concept of data mining and data warehousing<br>• To learn the classification and prediction techniques in data mining<br>• To study the mining of time series data<br>• To know the methodologies for stream data processing and stream data systems<br>• To analyse the techniques for web mining |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Understand the concept of data warehousing and mining techniques<br>2. Gain knowledge on different clustering methods<br>3. Perform analytics on Time series Data and extracting knowledge<br>4. Illustrate pattern mining in stream data and Analysis of Social Network Data<br>5. Explain the extracting of information from the web data and types of web mining |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked
based on the number of hours notified against each unit in the syllabus**.**

**Introduction to Data Warehousing**

Data Mining: Mining frequent patterns, association and correlations; Sequential Pattern Mining concepts, primitives, scalable methods. [9]

**Classification and Prediction**

Cluster Analysis – Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods; Transactional Patterns and other temporal based frequent patterns. [9]

**Mining Time Series Data**

Periodicity Analysis for time related sequence data, Trend analysis, Similarity search in Time-series analysis **[8]**

**Mining Data Streams**

Methodologies for stream data processing and stream data systems, Frequent pattern mining in stream data, Sequential Pattern Mining in Data Streams, Classification of dynamic data streams, Class Imbalance Problem; Graph Mining; Social Network Analysis. [9]

**Web Mining**

Mining the web page layout structure, mining web link structure, mining multimedia data on the web, Automatic classification of web documents and web usage mining; Distributed Data Mining.

**Recent Trends**

Recent trends in Distributed Warehousing and Data Mining, Class Imbalance Problem; Graph Mining; Social Network Analysis [10]

**Total Hours: 45**

Text Book(s):


| | |
|---|---|
| 1 | Jiawei Han and M Kamber, Data Mining Concepts and Techniques,, Second Edition, Elsevier Publication, 2011. |
| 2 | Mathew A. Russell, Mikhail Klassen, “Mining The Social Web: Data Mining Facebbok, Twitter, Linkedin, Instagram, Github and More, Third Edition, O’Reilly. |


Reference Book(s) :


| | |
|---|---|
| 1 | Vipin Kumar, Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach, Addison Wesley, 2006. |
| 2 | Adriaan, “Introduction to Data Mining”, Addison Wesley Publication |
| 3 | A.K.Pujari, “Data Mining Techniques”, University Press |
| 4 | G Dong and J Pei, Sequence Data Mining, Springer, 2007. |

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|---|---|---|---|---|---|---|---|---|
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| **Elective I** | | | | | | | | |
| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E14** | **Distributed Database** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |
| Objective(s) | • To provide insight to distributed data processing and distributed database system<br>• To understand the distributed DBMS architecture<br>• To study the query processing and transaction management<br>• To devise the parallel database systems and its architecture<br>• To analyse the distributed object database management systems | | | | | | | |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Express the knowledge of relational database and distributed database concepts<br>2. Employ the concepts of distributed database architecture and design issues<br>3. Describe the various query processing and transaction processing techniques of distributed database<br>4. Express the knowledge of parallel database<br>5. Describe the query processing and transaction processing of distributed object based model | | | | | | | |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Introduction**

Distributed Data processing, Distributed database system (DDBMS), Promises of DDBMSs, Complicating factors and Problem areas in DDBMSs, Overview Of Relational DBMS Relational Database concepts, Normalization, Integrity rules, Relational Data Languages, Relational DBMS. [9]

**Distributed DBMS Architecture**

DBMS Standardization, Architectural models for Distributed DBMS, Distributed DBMS Architecture. Distributed Database Design: Alternative design Strategies, Distribution design issues, Fragmentation, Allocation. Semantic Data Control: View Management, Data security, Semantic Integrity Control. [9]

**Overview of Query Processing**

Query processing problem, Objectives of Query Processing, Complexity of Relational Algebra operations, characterization of Query processors, Layers of Query Processing.

Introduction to Transaction Management: Definition of Transaction, Properties of transaction, types of transaction. Distributed Concurrency Control: Serializability theory, Taxonomy of concurrency control mechanisms, locking bases concurrency control algorithms. [9]

**Parallel Database Systems**

Database servers, Parallel architecture, Parallel DBMS techniques, Parallel execution problems, Parallel execution for hierarchical architecture. [9]

**Distributed Object Database Management systems**

Fundamental Object concepts and Object models, Object distribution design. Architectural issues, Object management, Distributed object storage, Object query processing. Transaction management. Database Interoperability: Database Integration, Query processing.

**Recent Trends**

Recent approaches, models and current trends in improving the performance of Distributed Database. [9]

**Total Hours: 45**

Text Book(s):

| | |
|---|---|
| 1 | M. Tamer Ozsu Patrick Valduriez, “Principles of Distributed Database Systems”, Fourth Edition, Springer. |
| 2 | Stefano Ceri, Giuseppe Pelagatti, “Distributed Databases principles and systems”, Tata McGraw Hill. |

Reference Book(s) :

| | |
|---|---|
| 1 | Frank S. Haug and Saeed K. Rahimi, “Distributed Database Management Systems: A Practical Approach”, Wiley, 2010. |
| 2 | Chhanda Ray, “Distributed Database Systems”, Pearson Education, 2009. |
| 3 | Ikvinderpal Singh, “Distributed Database Systems”, Khanna Book Publishing Co.(p) Ltd |
| 4 | Mohamed Osman Hegazi, “Distributed Database Systems Integration – Models and Approaches”, Lambert Academic Publishing. |

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|---|---|---|---|
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**Elective I**

| Course Code | Course Name | Hours/Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E15** | **Network Security** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |

| | |
|---|---|
| Objective(s) | • To understand various security measures<br>• To learn the threats and securities of a system<br>• To study the security policies and procedures<br>• To plan the security on various situations<br>• To know about operations of security |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Understand basics of security<br>2. Analyse the various threats and vulnerabilities of system<br>3. Know on various security plannings<br>4. Apply various security policies and procedures<br>5. Describe the use of Operations Security(OPSEC) |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Security basics**

Information Security (INFOSEC) Overview: critical information characteristics – availability information states – processing security countermeasures_education, training and awareness, critical information characteristics – confidentiality critical information characteristics – integrity, information states – storage, information states – transmission, security countermeasures_policy, procedures and practices, threats, vulnerabilities. [9]

**Threats to and Vulnerabilities of Systems**

Definition of terms (e.g., threats, vulnerabilities, risk), major categories of threats (e.g., fraud, Hostile Intelligence Service (HOIS), malicious logic, hackers, environmental and technological hazards, disgruntled employees, careless employees, HUMINT, and monitoring), threat impact areas, Countermeasures: assessments (e.g., surveys, inspections), Concepts of Risk Management: consequences (e.g., corrective action, risk assessment), cost/benefit analysis of controls, implementation of cost_effective controls, monitoring the efficiency and effectiveness of controls (e.g., unauthorized or inadvertent disclosure of information), threat and vulnerability assessment [9]

**Security Planning**

Directives and procedures for policy mechanism, Risk Management: acceptance of risk (accreditation), corrective actions information identification, risk analysis and/or vulnerability assessment components, risk analysis results evaluation, roles and responsibilities of all the players in the risk analysis process, Contingency Planning/Disaster Recovery: agency response procedures and continuity of operations, contingency plan components, determination of backup requirements, development of plans for recovery actions after a disruptive event, development of procedures for off_site processing, emergency destruction procedures, guidelines for determining critical and essential workload, team member responsibilities in responding to an emergency situation [9]

**Policies and procedures**

Physical Security Measures: alarms, building construction, cabling, communications centre, environmental controls (humidity and air conditioning), filtered power, physical access control systems (key cards, locks and alarms) Personnel Security Practices and Procedures: access authorization/verification (need_to_know), contractors, employee clearances, position sensitivity, security training and awareness, systems maintenance personnel, Administrative Security Procedural Controls: attribution, copyright protection and licensing , Auditing and Monitoring: conducting security reviews, effectiveness of security programs, investigation of security breaches, privacy review of accountability controls, review of audit trails and logs [9]

**Operations Security (OPSEC):**

OPSEC surveys/OPSEC planning INFOSEC: computer security – audit, cryptography_encryption (e.g., point_to_point, network, link), cryptography_key management (to include electronic key), cryptography_strength (e.g., complexity, secrecy, characteristics of the key) [9]

**Case Study:**

Case study of threat and vulnerability assessment **Total Hours: 45**

Text Book(s):

| | |
|---|---|
| 1 | Roberta Bragg, Mark Rhodes-Ousley, Keith Strassberg, “Network Security: The Complete Reference”, Ist Edition, Tata McGraw-Hill Edition, 2004. |
| 2 | William Stallings, “Cryptography and Network Security Principles and Practice”, Sixth Edition, Pearson Education |

| Reference Book(s) : | |
|---|---|
| 1. | Neha Ghai, “Network Security”, Kataria, S. K., & Sons, 2013. |
| 2. | Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill, 2003. |
| 3. | Harrington, “Network Security: A Practical Approach”, ELSEVIER, 2005 |
| 4. | Eric Maiwald, “Fundamentals of Network Security”, McGraw Hill, 2010 |

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**Elective II**

| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E21** | **Data Encryption and Compression** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |

| | |
|---|---|
| Objective(s) | • To know the concept of security , types of attack experienced, encryption and authentication for deal with various attacks<br>• To understand symmetric, asymmetric Key cryptography and user authentication mechanism<br>• To study about public key cryptography and message authentication<br>• To learn data compression and methods of data compression<br>• To acquire the knowledge about entropy encoding techniques |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Understand the basic needs of Security and types of attacks<br>2. Realize the Encryption techniques, Symmetric and Asymmetric key Cryptography<br>3. Analyze the User Authentication Mechanism<br>4. Understand the Public –key Cryptography and Message Authentication<br>5. Recognize the Data Compression techniques and Entropy encoding |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Introduction to Security:** Need for security, Security approaches, Principles of security, Types of attacks.
**Encryption Techniques:** Plaintext, Cipher text, Substitution & Transposition techniques, Encryption & Decryption, Types of attacks, Key range & Size. [9]
**Symmetric and Asymmetric Key Cryptography:** Algorithm types & Modes, DES, IDEA, Differential & Linear Cryptanalysis, RSA, Symmetric & Asymmetric key together, Digital signature, Knapsack algorithm. [7]
**User Authentication Mechanism:** Authentication basics, Passwords, Authentication tokens, Certificate based & Biometric authentication, Firewall.
**Case Studies of Cryptography:** Denial of service attacks, IP spoofing attacks, Secure inter branch payment transactions, Conventional Encryption and Message Confidentiality, Conventional Encryption Principles, Conventional Encryption Algorithms, Location of Encryption Devices, Key Distribution.
**Public Key Cryptography and Message Authentication:** Approaches to Message Authentication, SHA-1, MD5, Public-Key Cryptography Principles, RSA, Digital, Signatures, Key Management. [10]
**Data compression –** Introduction, Need for data compression, Fundamental concept of data compression & coding, Communication model, Compression ratio, Requirements of data compression, Classification.
**Methods of Data Compression:** Data compression-- Loss less &Lossy [9]
**Entropy Encoding** - Repetitive character encoding, Run length encoding, Zero/Blank encoding; Statistical encoding-- Huffman, Arithmetic & Lempel-Ziv coding; Source encoding-- Vector quantization (Simple vector quantization & with error term); Differential encoding—Predictive coding, Differential pulse code modulation, Delta modulation, Adaptive differential pulse code modulation; Transform based coding : Discrete cosine transform & JPEG standards; Fractal compression. Recent trends in encryption and data compression techniques. [10]

**Total Hours: 45**

Text Book(s) :

| | |
|---|---|
| 1 | Cryptography and Network Security by B. Forouzan, McGraw-Hill. |
| 2 | The Data Compression Book by Nelson, BPB. |

Reference Book(s):

| | |
|---|---|
| 1 | Cryptography & Network Security by AtulKahate, TMH. |
| 2 | James A. Storer, “Data Compression: Methods and Theory”, Computer Science Press, 1988 |
| 3 | David Salomon, “Data Compression: The Complete Reference”, 3rd Edition, Springer, 2004. |
| 4 | Colt McAnlis, Aleks Haecky, “Understanding Compression: Data Compression for Modern Developers” 1st Edition, O’Reilly, 2016. |

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| **Elective II** | | | | | | | | | |
| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | | |
| | | L | T | P | C | CA | ES | Total | |
| **50 PCS E22** | **Ethical Hacking** | 3 | 0 | 0 | 3 | 50 | 50 | 100 | |
| Objective(s) | • To know the concept of Ethical Hacking and Ethical Disclosure<br>• To understand Penetration Testing and Tools<br>• To study about Vulnerability Analysis<br>• To learn Client-side Browser Exploits<br>• To acquire the knowledge about Malware Analysis techniques | | | | | | | | |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Understand the basic ethics of Ethical Hacking<br>2. Understand the Ethical Testing and their Tools<br>3. Identify and analyse Vulnerabilities and advance Reverse Engineering<br>4. Understand the Client-Side browser and their Vulnerability<br>5. Analyse the knowledge of Malware | | | | | | | | |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Introduction to Ethical Disclosure**
Ethics of Ethical Hacking, Ethical Hacking and the legal system, Proper and Ethical Disclosure [9]

**Penetration Testing and Tools**
Using Metasploit, Using BackTrackLiveCD Linux Distribution [9]

**Vulnerability Analysis**
Passive Analysis, Advanced Static Analysis with IDA Pro, Advanced Reverse Engineering [9]

**Client-side Browser Exploits**
Exploiting Windows Access Control Model for Local Elevation Privilege, Intelligent Fuzzing with Sulley, From Vulnerability to Exploit. [9]

**Malware Analysis**
Collecting Malware and Initial Analysis, Hacking Malware

**Case Study**
Case study of vulnerability of cloud platforms and mobile platforms & devices. [9]

**Total Hours: 45**

Text Book(s) :


| | |
|---|---|
| 1 | Principles of Distributed Database Systems, Second Edition, M. Tamer Ozsu Patrick Valduriez |
| 2 | Distributed Databases principles and systems, Stefano Ceri, Giuseppe Pelagatti, Tata McGraw Hill. |


Reference Book(s):


| | |
|---|---|
| 1 | Jon Erickson, “Hacking: The Art of Exploitation”, 2nd Edition, No Starch Press, 2008. |
| 2 | Harsh Bothra, “HACKING: BE A HACKER WITH ETHICS”, Khanna Publishing, 2017. |
| 3 | Harsh Bothra, “Mastering Hacking: The Art of Information Gathering & Scanning”, 1st edition, Khanna Publishing, 2019. |
| 4 | Mayank Bhushan, Rajkumar Singh Rathore and Aatif Jamshed, “Fundamental of Cyber Security”, BPB Publications, 2018. |

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| **Elective II** | | | | | | | | | |
| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | | |
| | | L | T | P | C | CA | ES | Total | |
| **50 PCS E23** | **Mobile and Pervasive Computing** | 3 | 0 | 0 | 3 | 50 | 50 | 100 | |
| Objective(s) | • To learn the basic architecture and concepts till Third Generation Communication systems<br>• To understand the latest 4G Telecommunication System Principles<br>• To introduce the broad perspective of pervasive concepts and management<br>• To explore the HCI concepts in Pervasive environment<br>• To apply the pervasive concepts in mobile environment | | | | | | | | |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Obtain a thorough understanding of basic architecture and concepts of till Third Generation Communication systems<br>2. Explain the latest 4G Telecommunication System Principles<br>3. Incorporate the pervasive concepts<br>4. Implement the HCI in Pervasive environment<br>5. Work on the pervasive concepts in mobile environment | | | | | | | | |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Introduction**

History – Wireless communications: GSM – DECT – TETRA – UMTS – IMT – 2000 – Blue tooth, WiFi, WiMAX, 3G ,WATM.- Mobile IP protocols -WAP push architecture-Wml scripts and applications. Data networks – SMS – GPRS – EDGE – Hybrid Wireless100 Networks – ATM – Wireless ATM. [9]

**Overview of a Modern 4G Telecommunications System**

Introduction. LTE-A System Architecture. LTE RAN. OFDM Air Interface. Evolved Packet Core. LTE Requirements. LTE-Advanced. LTE-A in Release. OFDMA – Introduction. OFDM Principles. LTE Uplink—SC-FDMA. Summary of OFDMA. [9]

**Pervasive Concepts and Elements**

Technology Trend Overview - Pervasive Computing: Concepts - Challenges - Middleware - Context Awareness - Resource Management - Human–Computer Interaction - Pervasive Transaction Processing - Infrastructure and Devices - Wireless Networks - Middleware for Pervasive Computing Systems - Resource Management - User Tracking- Context Management -Service Management - Data Management - Security Management - Pervasive Computing Environments - Smart Car Space - Intelligent Campus [9]

**HCI in Pervasive Computing**

Prototype for Application Migration - Prototype for Multimodalities - Human–Computer Interface in Pervasive Environments - HCI Service and Interaction Migration - Context-Driven HCI Service Selection - Interaction Service Selection Overview - User Devices - Service-Oriented Middleware Support - User History and Preference - Context Manager - Local Service Matching - Global Combination - Effective Region - User Active Scope - Service Combination Selection Algorithm [9]

**Pervasive Mobile Transactions**

Pervasive Mobile Transactions - Introduction to Pervasive Transactions - Mobile Transaction Framework - Unavailable Transaction Service - Pervasive Transaction Processing Framework – Context - Aware Pervasive Transaction Model - Context Model for Pervasive Transaction Processing - Context-Aware Pervasive Transaction Model - A Case of Pervasive Transactions - Dynamic Transaction Management - Context-Aware Transaction Coordination Mechanism - Coordination Algorithm for Pervasive Transactions - Participant Discovery - Formal Transaction Verification - Petri Net with Selective Transition. [9]

**Total Hours: 45**

Text Book(s) :


1. Alan Colman, Jun Han, and Muhammad Ashad Kabir, “Pervasive Social Computing Socially-Aware Pervasive Systems and Mobile Applications”, Springer, 2016.

| | |
|---|---|
| 2 | J.Schiller, “Mobile Communication”, Addison Wesley, 2000. |
| Reference Book(s): | |
| 1 | Juha Korhonen, “Introduction to 4G Mobile Communications” , Artech House Publishers, 2014 |
| 2 | Frank Adelstein, Sandeep Gupta, Golden Richard and Loren Schwiebert, “Fundamentals of Mobile and Pervasive Computing”, McGraw-Hill Education, 2005 |
| 3 | Ciprian Dobre Fatos Xhafa, “Pervasive Computing - Next Generation Platforms for Intelligent Data Collection”, 1st Edition, Academic Press, 2016. |
| 4 | Mohammad S. Obaidat, Mieso Denko, Isaac Woungang, “Pervasive Computing and Networking”, 1st Edition, Wiley, 2011. |

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**Elective II**

| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E24** | **Recommender System** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |

| | |
|---|---|
| Objective(s) | • To understand the various searching techniques<br>• To learn the various types of content based filtering and collaborative filtering<br>• To learn the various hybridization design<br>• To acquire the knowledge of evaluating recommender system<br>• To learn the various types of recommender system |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Learn the key concepts of information retrieval, various searching techniques<br>2. Gain the knowledge of various types of content based filtering and collaborative filtering<br>3. Understand the various hybridization design<br>4. Acquire the knowledge of evaluating recommender system<br>5. Learn the various types of recommender system |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Introduction**

Overview of Information Retrieval, Retrieval Models, Search and Filtering Techniques: Relevance Feedback, User Profiles, Recommender system functions, Matrix operations, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system. [9]

**Content-based Filtering**

High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, pre-processing and feature extraction, Obtaining item features from tags, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

**Collaborative Filtering**

User-based recommendation, Item-based recommendation, Model based approaches, Matrix factorization, Attacks on collaborative recommender systems. [10]

**Hybrid Approaches**

Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies. [8]

**Evaluating Recommender System**

Introduction, General properties of evaluation research, Evaluation designs: Accuracy, Coverage, confidence, novelty, diversity, scalability, serendipity, Evaluation on historical datasets, Offline evaluations. [9]

**Types of Recommender Systems**

Recommender systems in personalized web search, knowledge-based recommender system, Social tagging recommender systems, Trust-centric recommendations, Group recommender systems. **[9]**

**Total Hours: 45**

Text Book(s) :


| | |
|---|---|
| 1 | Jannach D., Zanker M. and FelFering A., "Recommender Systems: An Introduction", First Edition, Cambridge University Press, 2011. |
| 2 | Charu C. Aggarwal, "Recommender Systems: The Textbook", Ist Edition, Springer, 2016. |


Reference Book(s):


| | |
|---|---|
| 1 | Ricci F., Rokach L., Shapira D., Kantor B.P., "Recommender Systems Handbook", Ist edition, Springer, 2011. |
| 2 | Kembellec Gerald, "Recommender Systems", ISTE Ltd and John Wiley & Sons Inc, 2014. |
| 3 | Manouselis N., Drachsler H., Verbert K., Duval E., "Recommender Systems For Learning", First Edition, Springer, 2013. |
| 4 | Lior Rokach, Bracha Shapira, Francesco Ricci, Paul B. Kantor, "Recommender Systems Handbook", Springer US, 2011. |

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**Elective II**

| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E25** | **Reconfigurable Computing** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |

| | |
|---|---|
| Objective(s) | • Learn and understand the Device architectures<br>• Understand the processing of Fabric architectures and reconfiguration management<br>• Learn and understand the HDL programming environment for FPGA applications<br>• Understand the technological mapping ,configuration and routing in Reconfigurable platforms<br>• Acquire the knowledge to develop FPGA applications and designs |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Acquire knowledge about various device architectures<br>2. Knowledge to perform processing fabric architectures and reconfiguration management<br>3. Learn to program various FPGA applications in HDL environment<br>4. Ability to perform technology mapping and reconfiguration bit stream management<br>5. Develop applications on FPGA and designing Chips |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Device Architecture**

General Purpose Computing Vs Reconfigurable Computing – Simple Programmable Logic Devices – Complex Programmable Logic Devices – FPGAs – Device Architecture - Case Studies. [9]

**Reconfigurable Computing Architectures and Systems**

Reconfigurable Processing Fabric Architectures – RPF Integration into Traditional Computing Systems – Reconfigurable Computing Systems – Case Studies – Reconfiguration Management. [9]

**Programming Reconfigurable Systems**

Compute Models - Programming FPGA Applications in HDL – Compiling C for Spatial Computing – Operating System Support for Reconfigurable Computing. [9]

**Mapping Designs To Reconfigurable Platforms**

The Design Flow - Technology Mapping – FPGA Placement and Routing – Configuration Bitstream Generation – Case Studies with Appropriate Tools. [9]

**Application Development With Fpgas**

Case Studies of FPGA Applications – System on a Programmable Chip (SoPC) Designs. [9]

**Total Hours: 45**

Text Book(s):

| | |
|---|---|
| 1 | Christophe Bobda, “Introduction to Reconfigurable Computing – Architectures, Algorithms and Applications”, Springer, 2010. |
| 2 | Maya B. Gokhale and Paul S. Graham, “Reconfigurable Computing: Accelerating Computation with Field-Programmable Gate Arrays”, Springer, 2005. |

Reference Book(s):

| | |
|---|---|
| 1 | Nicole Hemsoth, Timothy Prickett Morgan, “FPGA Frontiers: New Applications in Reconfigurable Computing”, Next Platform, 2017. |
| 2 | Joao Cardoso (Editor), Michael Hübne, “Reconfigurable Computing: From FPGAs to Hardware/Software Codesign”, First Edition, Springer-Verlag New York, 2011. |
| 3 | Scott Hauck and Andre Dehon (Eds.), “Reconfigurable Computing – The Theory and Practice of FPGA-Based Computation”, Elsevier / Morgan Kaufmann, 2008. |
| 4 | Scott Hauck André DeHon, “Reconfigurable Computing”, Volume 1, 1st Edition, Morgan Kaufmann, 2007. |

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| **Elective III** | | | | | | | | |
| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E31** | **Data Preparation and Analysis** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |
| Objective(s) | • To understand the various data gathering and preparation techniques<br>• To learn the various types of data cleaning techniques<br>• To acquire the knowledge of exploratory analysis<br>• To learn the visualizations for different types of data<br>• To prepare the data for analysis and develop meaningful Data Visualizations | | | | | | | |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Work in a business environment in which data preparation occurs.<br>2. Apply data cleaning techniques on real world data and prepare data for analysis<br>3. Perform exploratory analysis on data, such as calculating descriptive and comparative statistics<br>4. Experiment visualization techniques for various data analysis tasks<br>5. Illustrate Clustering and association techniques | | | | | | | |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Data Gathering and Preparation:**
Data formats, parsing and transformation, Scalability and real-time issues [10]

**Data Cleaning:**
Consistency checking, Heterogeneous and missing data, Data Transformation and segmentation [11]

**Exploratory Analysis:**
Descriptive and comparative statistics, Clustering and association, Hypothesis Generation [12]

**Visualization:**
Designing visualizations, Time series, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity [12]

**Total Hours: 45**

Text Book(s):

| | |
|---|---|
| 1 | Making sense of Data : A practical Guide to Exploratory Data Analysis and Data Mining, by Glenn J. Myatt |
| 2 | Jason W. Osborne, “Best Practices in Data Cleaning”, First edition, SAGE Publications, Inc, 2012. |

Reference Book(s):

| | |
|---|---|
| 1 | Ihab F. Ilyas, Xu Chu, “Data Cleaning”, ACM Books, 2019. |
| 2 | Jacqueline Kazil, Katharine Jarmul, “Data Wrangling with Python”, 1st edition, O'Reilly Media, 2016. |
| 3 | Tye Rattenbury, Joseph M. Hellerstein, Jeffrey Heer, “Principles of Data Wrangling: Practical Techniques for Data Preparation”, 1st Edition, O'Reilly Media, 2017. |
| 4 | Bradley C. Boehmke, “Data Wrangling with R”, 1st Edition, Springer, 2016. |

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**Elective III**

| Course Code | Course Name | Hours/Week | | Credit | | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E32** | **Protocols and Architecture for Mobile Ad-Hoc Networks** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |

**Objective(s)**

- To learn the basics of Ad Hoc Wireless Networks
- To enhance the knowledge on Routing Protocols for Ad Hoc Wireless Networks
- To understand the multi cast routing in Ad Hoc Wireless Networks
- To learn the Security Protocols for Ad Hoc Wireless Networks
- To analyse the energy management in Ad Hoc Wireless Networks.

**Course Outcomes**

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

1. Understand the designing issues and classification of protocols in Ad-Hoc Networks
2. Apply the working principles of routing protocols for Ad-Hoc wireless networks
3. Apply the principles and concepts of multicast protocols in Ad-Hoc wireless networks
4. Identify the security requirement and design the secure routing protocols for Ad-Hoc wireless networks
5. Understand the various power management issues

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Introduction**

Ad Hoc Wireless Networks Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet; MAC Protocols for Ad Hoc Wireless Networks-Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols. [9]

**Routing Protocols for Ad Hoc Wireless Networks**

Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Power Aware Routing Protocols. [9]

**Multi Cast Routing in Ad Hoc Wireless Networks**

Issues in Designing a Multicast Routing Protocol, Classifications of Multicast Routing Protocols, Energy Efficient Multicasting, Multicasting with Quality of Service Guarantees, Application Dependent Multicast Routing. [9]

**Security Protocols for Ad Hoc Wireless Networks**

Security in Ad Hoc Wireless Networks. Network Security Requirements. Issues and Challenges in Security Provisioning. Network Security Attacks. Key Management. Secure Routing in Ad Hoc Wireless Networks. [9]

**Energy Management in Ad Hoc Wireless Networks**

Classification of Energy Management Schemes, Transmission Power Management Schemes, System Power Management Schemes. Special topics in Ad-hoc and wireless networks. [9]

**Total Hours: 45**

Text book(s) :


| | |
|---|---|
| 1 | C S. Ram Murthy, B. S. Manoj, Ad Hoc Wireless Networks: Architectures and Protocols, Prentice Hall of India, 2nd ed. 2005. |
| 2 | R. Hekmat, Ad hoc Networks: Fundamental Properties and Network Topologies, Springer, 1st ed. 2006. |


Reference Book(s) :


| | |
|---|---|
| 1 | B. Tavli and W. Heinzelman, Mobile Ad Hoc Networks: Energy Efficient Real Time Data Communications, Springer, 1st ed. 2006. |
| 2 | G. Anastasi, E. Ancillotti, R. Bernasconi, and E. S. Biagioni, Multi Hop Ad Hoc Newtorks from Theory to Reality, Nova Science Publishers, 2008 |
| 3 | Stefano Basagni, Marco Conti, Silvia Giordano, Ivan Stojmenovic, “Mobile Ad Hoc Networking”, John Wiley & Sons, 2004 |
| 4 | Reddy G Ram Mohana and Kiran M, “Mobile Ad Hoc Networks: Bio-Inspired Quality of Service Aware Routing Protocols”, Taylor & Francis Inc, 2016. |

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**Elective III**

| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E33** | **Secure Coding** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |

| | |
|---|---|
| Objective(s) | • Understand the basics of secure programming<br>• Understand the most frequent programming errors leading to software vulnerabilities<br>• Identify and analyze security problems in software<br>• Understand and protect against security threats and software vulnerabilities<br>• Effectively apply their knowledge to the construction of secure software systems |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Understand the basics of secure programming<br>2. Understand the most frequent programming errors leading to software Vulnurablitiy and its Security<br>3. Identify and analyze software security fundamentals, SQL injections, Failure to Handle the Errors and Security Touch points<br>4. Understand the Cross Site Scripting, weak password and improper use of cryptography<br>5. Analyze the knowledge of Information Leakage and trusting network name resolution |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Introduction**

Introduction to software security, Managing software security risk, Selecting software development technologies, An open source and closed source, Guiding principles for software security, Auditing software, Buffet overflows, Access control, Race conditions, Input validation, Password authentication [9]

**Attacks**

Anti-tampering, Protecting against denial of service attack, Copy protection schemes, Client-side security, Database security, Applied cryptography, Randomness and determinism [9]

**Software Security**

Buffer Overrun, Format String Problems, Integer Overflow, and Software Security Fundamentals
SQL Injection, Command Injection, Failure to Handle Errors, and Security Touchpoints. [9]

**Cross Site Scripting**

Cross Site Scripting, Magic URLs, Weak Passwords, Failing to Protect Data, Weak random numbers, improper use of cryptography. [9]

**Information Leakage**

Information Leakage, Race Conditions, Poor usability, Failing to protect network traffic, improper use of PKI, trusting network name resolution

**Case Study**

Case study of Cross Site Scripting, Magic URLs, Weak Passwords Buffet overflows, Access control, Race conditions. [9]

**Total Hours: 45**

Text book(s) :

| | |
|---|---|
| 1 | J. Viega, M. Messier, “Secure Programming Cookbook for C and C++”, 1st edition, O′Reilly, 2003. |
| 2 | M. Howard, D. LeBlanc, “Writing Secure Code”, 2nd edition, Microsoft Press US, 2002. |

Reference Book(s) :

| | |
|---|---|
| 1 | Mark Graff, “Secure Coding – Principles & Practices”, 1st edition, O′Reilly, 2003. |
| 2 | Neil Daswani, Christoph Kern, and Anita Kesavan, “Foundations of Security”, 1st edition, Apress, 2007. |
| 3 | John Viega, Gary R., “Building Secure Software: How to Avoid Security Problems the Right Way”, 1st edition, Addison-Wesley Professional, 2001. |
| 4 | J. Viega, G. McGraw. Building Secure Software, Addison Wesley |

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**Elective III**

| Course Code | Course Name | Hours/Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E34** | **Software Quality Management** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |

**Objective(s)**

- To understand the Concept & Software Quality Management
- To know the software process Assessment
- To learn the software configuration Management
- To device the software standards
- To understand the software testing principles and principles of software defect prevention.

**Course Outcomes**

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

1. Outline the Software process assessment
2. Describe Software Configuration Management
3. Identify Software Quality Management Standards and inspections
4. Learn about Software Testing and Strategies
5. Understand defect prevention and management role

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Introduction**

Software Process assessment overview – Assessment phases – assessment principles – Assessment conduct – Implementation consideration – Quality management – Quality assurance plan – Considerations – Verification and Validation. [9]

**Configuration Management**

Need for configuration Management – Software product nomenclature – configuration management functions – Baselines – Responsibilities – Need for automated tools – plan – SCM support functions – The requirement phase Design control – The implementation phase – Test phase – SCM Tools – Configuration accounting and audit. [9]

**Software Standards and Inspection**

Definitions – Reason for software standards – Benefits – Establishing standards – Guidelines – Types of reviews – Inspection of objectives – Basic inspection principles – The conduct of inspection – Inspection training. [9]

**Testing and Management Software Quality**

Testing: principles – Types – Planning – Development – Execution and reporting – Tools and methods – Real Time testing – Quality management paradigm – Quality motivation – Measurement criteria – Establishing a software quality program – Estimating software quality. [9]

**Defect Prevention**

Principles of software defect prevention – Process changes for defect prevention – Defect prevention consideration – Managements role – Framework for software process change – Managing resistance to software process change. [9]

**Total Hours: 45**

Text book(s) :

| | |
|---|---|
| 1 | Watts S. Humphrey, “Managing the software process”, Addison Wesley, 1999. |
| 2 | Daniel Galin, “Software Quality: Concepts and Practice”, 1st edition, Wiley-IEEE Computer Society press, 2018. |

Reference(s):

| | |
|---|---|
| 1 | TsumS.Chow, “Software Quality Assurance a Practical Approach”, IEEE Computer Society press, 1985. |
| 2 | Richard E. Fairley, “Software Engineering – A Practitioner’s approach”, McGraw Hill, 1982. |
| 3 | Claude Y. Laporte, Alain April, “Software Quality Assurance”, 1st edition, Wiley-IEEE Computer Society press, 2017. |
| 4 | Kshirasagar Naik, Priyadarshi Tripathy, “Software Testing and Quality Assurance: Theory and Practice”, Wiley, 2011. |

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| **Elective III** | | | | | | | | |
| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E35** | **Wireless Sensor Networks** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |

| | |
|---|---|
| Objective(s) | • Architect sensor networks for various application setups<br>• Devise appropriate data dissemination protocols and model links cost<br>• Understanding the fundamental concepts of wireless sensor networks<br>• To have a basic knowledge of the various protocols at various layers<br>• Evaluate the performance of sensor networks and identify bottlenecks |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Understand the fundamental concepts of wireless Sensor Networks and its architecture<br>2. Illustrate the operations of Network Simulator-3<br>3. Apply Discrete time Markov Chain and describe MAC Protocol design<br>4. Summarize the varies attacks and Static and Dynamic Key Distribution<br>5. Describe the MANET protocols and Software applications |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Introduction to Wireless Sensor Networks:** Course Information, Introduction to Wireless Sensor Networks: Motivations, Applications, Performance metrics, History and Design factors
**Network Architecture:** Traditional layered stack, Cross-layer designs, Sensor Network Architecture
**Hardware Platforms:** Motes, Hardware parameters [9]

**Introduction to ns-3: I**ntroduction to Network Simulator 3 (ns-3), Description of the ns-3 core module and simulation example. [9]

**Medium Access Control Protocol design:** Fixed Access, Random Access, WSN protocols: synchronized, duty-cycled - **Introduction to Markov Chain:** Discrete time Markov Chain definition, properties, classification and analysis - **MAC Protocol Analysis:** Asynchronous duty-cycled. X-MAC Analysis(Markov Chain) [10]

**Security**: Possible attacks, countermeasures, SPINS, Static and dynamic key distribution. [8]

**Routing Protocols:** Introduction, MANET protocols - **Routing protocols for WSN**: Resource-aware routing, Data-centric, Geographic Routing, Broadcast, Multicast - **Opportunistic Routing Analysis**: Analysis of opportunistic routing (Markov Chain) Advanced topics in wireless sensor networks.
**Advanced topics**
Recent development in WSN standards, software applications. [9]

**Total Hours: 45**

Text book(s) :

| | |
|---|---|
| 1 | W. Dargie and C. Poellabauer, "Fundamentals of Wireless Sensor Networks –Theory and Practice", Wiley 2010. |
| 2 | Kazem Sohraby, Daniel Minoli and TaiebZnati, "wireless sensor networks -Technology, Protocols, and Applications", Wiley Interscience, 2007. |

Reference book(s) :

| | |
|---|---|
| 1 | Takahiro Hara,Vladimir I. Zadorozhny, and Erik Buchmann, "Wireless Sensor Network Technologies for the Information Explosion Era", springer, 2010. |
| 2 | Zheng Jun, Abbas Jamalipour, "Wireless Sensor Networks - A Networking Perspective", Wiley india Pvt. Ltd |
| 3 | C.S. Raghavendra, Krishna M. Sivalingam, Taieb Znati, "Wireless Sensor Networks", First Edition, Springer, 2004. |
| 4 | Andreas Willig Holger Karl, "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2011. |

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| **Elective IV** | | | | | | | | |
| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E41** | **Biometrics** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |
| Objective(s) | • To learn the introduction and definition of Bio-metric and traditional authentication methods.<br>• To know the various Bio-metric technologies<br>• To understand the application of bio-metric systems in government sector<br>• To apply the various face recognition and finger print recognition methods in case studies<br>• To identify the recent trends in Bio-metric technologies and applications in various domains | | | | | | | |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Know the fundamental concepts of bio-metrics and traditional authenticated methods<br>2. Illustrate the various Bio-metric technologies<br>3. Recognize the law and the use of multi bio-metrics systems<br>4. Apply statistical measurement of Bio-metric in various sectors<br>5. Identify the recent trends in Bio-metric technologies and applications in various domains | | | | | | | |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Introduction**

Introduction and Definitions of bio-metrics, Traditional authenticated methods and technologies. [9]

**Bio-metric technologies:** Fingerprint, Face, Iris, Hand Geometry, Gait Recognition, Ear, Voice, Palm print, On-Line Signature Verification, 3D Face Recognition, Dental Identification and DNA.
The Law and the use of multi bio-metrics systems. [9]

**Statistical measurement of Bio-metric -** Bio-metrics in Government Sector and Commercial Sector. [9]

**Case Studies**

Case Studies of bio-metric system, Bio-metric Transaction. Bio-metric System Vulnerabilities. [9]

**Recent trends**

Recent trends in Bio-metric technologies and applications in various domains.
Case study of 3D face recognition and DNA matching. [9]

**Total Hours: 45**

Text book(s) :

| | |
|---|---|
| 1 | Biometrics for network security, Paul Reid, Hand book of Pearson |
| 2 | D. Maltoni, D. Maio, A. K. Jain, and S. Prabhakar, Handbook of Fingerprint Recognition, Springer Verlag, 2003. |

Reference book(s) :

| | |
|---|---|
| 1 | A. K. Jain, R. Bolle, S. Pankanti (Eds.), BIOMETRICS: Personal Identification in Networked Society, Kluwer Academic Publishers, 1999. |
| 2 | J. Wayman, A.K. Jain, D. Maltoni, and D. Maio (Eds.), Biometric Systems: Technology, Design and Performance Evaluation, Springer, 2004. |
| 3 | Anil Jain, Arun A. Ross, Karthik Nanda kumar, Introduction to biometric, Springer, 2011. |
| 4 | Biometric Systems: Technology, Design and Performance Evaluation, J. Wayman, A.K. Jain, D. Maltoni, and D. Maio |

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**Elective IV**

| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E42** | **GPU Computing** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |

| | |
|---|---|
| Objective(s) | • To learn parallel programming with Graphics Processing Units (GPUs).<br>• To know the Performance evaluation with different memories<br>• To understand the Synchronization concepts for CPU and GPU and device various kernel functions and libraries<br>• To know the GPU programs and know the working principle of asynchronous processing<br>• To get the knowledge of GPU computing in various applications |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Learn concepts in parallel programming, implementation of programs on GPUs, debugging and profiling parallel programs.<br>2. Analyse the Performance evaluation with different memories<br>3. Interpret the Synchronization concepts for CPU and GPU and device various kernel functions and libraries<br>4. Analyse the GPU programs and know the working principle of asynchronous processing<br>5. Apply the knowledge of GPU computing in various applications |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked
based on the number of hours notified against each unit in the syllabus**.**

**Introduction:** History, Graphics Processors, Graphics Processing Units, GPGPUs. Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel programming, CUDA OpenCL / OpenACC, Hello World Computation Kernels, Launch parameters, Thread hierarchy, Warps / Wavefronts, Thread blocks / Workgroups, Streaming multiprocessors, 1D / 2D / 3D thread mapping, Device properties, Simple Programs.[9]

**Memory:** Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-dimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories. [9]

**Synchronization:** Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Worklists, Linked-lists. Synchronization across CPU and GPU
**Functions:** Device functions, Host functions, Kernels functions, Using libraries (such as Thrust), and developing libraries. [9]

**Support:** Debugging GPU Programs. Profiling, Profile tools, Performance aspects
**Streams:** Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based Synchronization - Overlapping data transfer and kernel execution, pitfalls.
**Case Studies:** Image Processing, Graph algorithms, Simulations, Deep Learning. [9]

**Advanced topics:** Dynamic parallelism, Unified Virtual Memory, Multi-GPU processing, Peer access, Heterogeneous processing. [9]

**Total Hours: 45**

Text book(s) :


| | |
|---|---|
| 1 | David Kirk, Wen-meiHwu, “Programming Massively Parallel Processors: A Hands-on Approach” Morgan Kaufman, 2010 (ISBN: 978-0123814722) |

| | |
|---|---|
| 2 | Shane Cook, “CUDA Programming: A Developer's Guide to Parallel Computing with GPUs”, Morgan Kaufman; 2012 (ISBN: 978-0124159334) |
| Reference book(s) : | |
| 1 | Gerassimos Barlas, “Multicore and GPU Programming: An Integrated Approach” Morgan Kaufmann, 1st edition (December 1, 2014) |
| 2 | Dr. Brian Tuomanen, “Hands-On GPU Programming with Python and CUDA: Explore high-performance parallel computing with CUDA”, Packt Publishing (November 27, 2018) |
| 3 | Avimanyu Bandyopadhyay, “Hands-On GPU Computing with Python: Explore the capabilities of GPUs for solving high performance computational problems”, Packt Publishing (May 14, 2019) |
| 4 | Jason Sanders, Edward Kandrot, “CUDA by Example: An Introduction to General-Purpose GPU Programming”, Addison-Wesley Professional, 1st edition (July 19, 2010) |

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**Elective IV**

| Course Code | Course Name | Hours / Week | | Credit | | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E43** | **Natural Language Processing** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |

| | |
|---|---|
| Objective(s) | • To study about Natural Language Processing<br>• To learn about information retrieval architecture<br>• To study about text mining.<br>• To know the concepts of multilingualism concepts<br>• To understand the various applications in machine translation and natural language generation |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Know the fundamental concepts of Natural Language Processing<br>2. Illustrate the Information Retrieval architecture<br>3. Recognize the text mining and pattern extraction techniques<br>4. Apply multilingual Information Retrieval and Speech processing in various applications<br>5. Identify the applications in machine translation and natural language generation |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked
based on the number of hours notified against each unit in the syllabus**.**

**Introduction**

Natural Language Processing – Linguistic Background- Spoken language input and output Technologies – Written language Input - Mathematical Methods - Statistical Modeling and Classification Finite State methods Grammar for Natural Language Processing – Parsing – Semantic and Logic Form – Ambiguity Resolution – Semantic Interpretation [9]

**Information Retrieval**

Information Retrieval architecture - Indexing- Storage – Compression Techniques – Retrieval Approaches – Evaluation - Search engines- commercial search engine features- comparison- performance measures – Document Processing - NLP based Information Retrieval – Information Extraction [9]

**Text Mining**

Categorization – Extraction based Categorization- Clustering- Hierarchical Clustering- Document Classification and routing- finding and organizing answers from Text search – use of categories and clusters for organizing retrieval results – Text Categorization and efficient Summarization using Lexical Chains – Pattern Extraction.[9]

**Generic Issues**

Multilingualism – Multilingual Information Retrieval and Speech processing - Multimodality – Text and Images – Modality Integration - Transmission and Storage – Speech coding- Evaluation of systems – Human Factors and user Acceptability. [9]

**Applications**

Machine Translation – Transfer Metaphor - Interlingua and Statistical Approaches - Discourse Processing – Dialog and Conversational Agents – Natural Language Generation – Surface Realization and Discourse Planning. [9]

**Total Hours: 45**

Text book(s) :


| | |
|---|---|
| 1 | Daniel Jurafsky and James H. martin, " Speech and Language Processing" , 2000 |
| 2 | Ron Cole, J.Mariani, et.al "Survey of the State of the Art in Human Language Technology", Cambridge University Press, 1997. |


Reference book(s) :


| | |
|---|---|
| 1 | Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit", O'Reilly Media; 1st edition (July 21, 2009) |
| 2 | Sowmya Vajjala, Bodhisattwa Majumder and Anuj Gupta, "Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems" O'Reilly Media; 1st edition (July 7, 2020) |
| 3 | Michael W. Berry " Survey of Text Mining: Clustering, Classification and Retrieval", Springer Verlag, 2003 |
| 4 | Christopher D.Manning and HinrichSchutze, "Foundations of Statistical Natural Language Processing ", MIT Press, 1999. |

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| **Elective IV** | | | | | | | | |
| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E44** | **Speech Processing and Synthesis** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |
| Objective(s) | • To understand the mathematical foundations needed for speech processing<br>• To understand the basic concepts and algorithms of speech processing and synthesis<br>• To familiarize the students with the various speech signal representation, coding and recognition techniques<br>• To appreciate the use of speech processing in current technologies<br>• To expose the students to real– world applications of speech processing | | | | | | | |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Know the fundamentals of speech processing<br>2. Illustrate the speech signal representations and coding<br>3. Recognize the speech recognition with Hidden Markov Models<br>4. Learn about Text analysis using various techniques<br>5. Identify the parameters of speech synthesis system | | | | | | | |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Fundamentals of Speech Processing**

Introduction – Spoken Language Structure – Phonetics and Phonology – Syllables and Words – Syntax and Semantics – Probability, Statistics and Information Theory – Probability Theory – Estimation Theory – Significance Testing – Information Theory. [9]

**Speech Signal Representations and Coding**

Overview of Digital Signal Processing – Speech Signal Representations – Short time Fourier Analysis – Acoustic Model of Speech Production – Linear Predictive Coding – Cepstral Processing – Formant Frequencies – The Role of Pitch – Speech Coding – LPC Coder. [9]

**Speech Recognition**

Hidden Markov Models – Definition – Continuous and Discontinuous HMMs – Practical Issues – Limitations. Acoustic Modeling – Variability in the Speech Signal – Extracting Features – Phonetic Modeling – Adaptive Techniques – Confidence Measures – Other Techniques. [9]

**Text Analysis**

Lexicon – Document Structure Detection – Text Normalization – Linguistic Analysis – Homograph Disambiguation – Morphological Analysis – Letter-to-sound Conversion – Prosody – Generation schematic – Speaking Style – Symbolic Prosody – Duration Assignment – Pitch Generation. [9]

**Speech Synthesis**

Attributes – Formant Speech Synthesis – Concatenative Speech Synthesis – Prosodic Modification of Speech – Source-filter Models for Prosody Modification – Evaluation of TTS Systems. [9]

**Total Hours: 45**

Text book(s) :


1. Joseph Mariani, —Language and Speech Processing‖, Wiley, 2009
2. Lawrence Rabiner and Biing-Hwang Juang, —Fundamentals of Speech Recognition‖, Prentice Hall Signal Processing Series, 1993.


Reference book(s) :


1. Sadaoki Furui, —Digital Speech Processing: Synthesis, and Recognition, Second Edition, (Signal Processing and Communications), Marcel Dekker, 2000.
2. Thomas F.Quatieri, —Discrete-Time Speech Signal Processing‖, Pearson Education, 2002.
3. Xuedong Huang, Alex Acero, Hsiao-Wuen Hon, —Spoken Language Processing – A guide to Theory, Algorithm and System Development‖, Prentice Hall PTR, 2001.
4. Thierry Dutoit, “An Introduction to Text-to-Speech Synthesis”, Springer Netherlands, First Edition, 1997.

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| **Elective IV** | | | | | | | | | |
| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | | |
| | | L | T | P | C | CA | ES | Total | |
| **50 PCS E45** | **Web Analytics and Development** | 3 | 0 | 0 | 3 | 50 | 50 | 100 | |
| Objective(s) | • To explore the use of social network analysis<br>• To understand the web analytics tools<br>• To introduce the web search and retrieval algorithms<br>• To know the social connection techniques<br>• To get the knowledge of robustness in social involvements and diffusion of innovation | | | | | | | | |
| Course Outcomes | **At the end of the course the student will be able to**<br>**1.** Gain the knowledge **of** Social network and Web data<br>**2.** Familiar with web analytics tools and development<br>**3.** Illustrate Web Search and Retrieval techniques<br>**4.** Identify the Affiliation and identity of social connects<br>**5.** Aware the robustness in social involvements and diffusion of innovation | | | | | | | | |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Introduction**
Social network and Web data and methods, Graph and Matrices, Basic measures for individuals and networks, Information Visualization. [9]

**Web Analytics tools**
Click Stream Analysis, A/B testing, Online Surveys. [9]

**Web Search and Retrieval**
Search Engine Optimization, Web Crawling and indexing, Ranking Algorithms, Web traffic models. [9]

**Making Connection**
Link Analysis, Random Graphs and Network evolution, Social Connects: Affiliation and identity. [9]

**Connection**
Connection Search, Collapse, Robustness Social involvements and diffusion of innovation. [9]

**Total Hours: 45**

Text book(s) :

| | |
|---|---|
| 1 | Hansen, Derek, Ben Sheiderman, Marc Smith. 2011. Analyzing Social Media Networks with NodeXL: Insights from a Connected World. Morgan Kaufmann, 304. |
| 2 | Avinash Kaushik. 2009. Web Analytics 2.0: The Art of Online Accountability. |

Reference book(s) :

| | |
|---|---|
| 1 | Easley, D. & Kleinberg, J. (2010). Networks, Crowds, and Markets: Reasoning About a Highly Connected World. New York: Cambridge University Press. |
| 2 | Wasserman, S. & Faust, K. (1994). Social network analysis: Methods and applications. New York: Cambridge University Press. Monge, P. R. & Contractor, N. S. (2003). |
| 3 | Pedro Sostre, Jennifer LeClaire, “Web Analytics For Dummies”, John Wiley & Sons (8 May 2007) |
| 4 | Himanshu Sharma, “Maths and Stats for Web Analytics and Conversion Optimization”, Optimize Smart; 1st edition (October 24, 2015) |

| K.S.Rangasamy College of Technology - Autonomous Regulation | | | | | | | | R 2018 |
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| Department | Computer Science and Engineering | Programme Code & Name | | PCS: M.E. Computer Science and Engineering | | | | |
| **Elective V** | | | | | | | | |
| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E51** | **Human and Computer Interaction** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |
| Objective(s) | • Learn the foundations of Human Computer Interaction<br>• Be familiar with the design technologies for individuals and persons with disabilities<br>• Be aware of mobile Human Computer interaction.<br>• To understand the mobile ecosystem<br>• To design web interfaces | | | | | | | |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Learn the foundations of Human Computer Interaction<br>2. Familiar with the design technologies for individuals and persons with disabilities<br>3. Aware of mobile Human Computer interaction<br>4. Design web interfaces using tools<br>5. Know about recent trends in Speech Recognition and Translation, Multimodal System | | | | | | | |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Human:** I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. [9]

**Interactive Design:** basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.
Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW. [10]

**Mobile Ecosystem:** Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. [9]

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies. [9]

**Recent Trends:** Speech Recognition and Translation, Multimodal System. [8]

**Total Hours: 45**

Text book(s) :


| | |
|---|---|
| 1 | Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, 3rd Edition, Pearson Education, 2004 (UNIT I , II & III) |
| 2 | Brian Fling, “Mobile Design and Development”, First Edition , OReilly Media Inc., 2009 (UNIT – IV) |


Reference book(s) :


| | |
|---|---|
| 1 | Bill Scott and Theresa Neil, “Designing Web Interfaces”, First Edition, OReilly, 2009.(UNIT-V) |
| 2 | Preece,J. et al, “Human-computer interaction”, Addison-Wesley Publishing Company, Inc., MA, 1994 |
| 3 | Shneiderman,B., “Designing the user interface: Strategies for effective human-computer interaction”, 2nd edition, Addison-Wesley Publishing Company,Inc.,Reading, MA, 1992 |
| 4 | Laurel, B., “The art of human-computer interface design”, Addison-Wesley Publishing Company, Inc., Reading MA, 1990 |

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| **Elective V** | | | | | | | | |
| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E52** | **Malware Analysis & Reverse Engineering** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |
| Objective(s) | • To provide an insight to fundamentals of malware analysis which includes analysis of JIT compilers for malware detection in legitimate code.<br>• To know the concept of malware forensics<br>• To understand the complexity of Malware and Kernel Debugging<br>• To get the knowledge of DNS filtering and reverse engineering<br>• To able to understand Researching and Mapping Source Domains/IPs | | | | | | | |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Understand the concept of malware and reverse engineering.<br>2. Implement tools and techniques of malware analysis.<br>3. Recognize the complexity of Malware and Kernel Debugging<br>4. Gain knowledge on Memory Forensics and Volatility<br>5. Learn the concepts of Researching and Mapping Source Domains/IPs | | | | | | | |

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**Malware Analysis**

Fundamentals of Malware Analysis (MA), Reverse Engineering Malware (REM) Methodology, Brief Overview of Malware analysis lab setup and configuration, Introduction to key MA tools and techniques, Behavioral Analysis vs. Code Analysis, Resources for Reverse-Engineering Malware (REM) Understanding Malware Threats, Malware indicators, Malware Classification, Examining ClamAVSignatures, Creating Custom ClamAV Databases, Using YARA to Detect Malware Capabilities, Creating a Controlled and Isolated Laboratory, Introduction to MA Sandboxes, Ubuntu, Zeltser'sREMnux, SANS SIFT, Sandbox Setup and Configuration New Course Form, Routing TCP/IP Connections, Capturing and Analyzing Network Traffic, Internet simulation using INetSim, Using Deep Freeze to Preserve Physical Systems, Using FOG for Cloning and Imaging Disks, Using MySQL Database to Automate FOG Tasks, Introduction to Python ,Introduction to x86 Intel assembly language, Scanners: Virus Total, Jotti, and NoVirus Thanks, Analyzers: Threat Expert, CWSandbox, Anubis, Joebox, Dynamic Analysis Tools: Process Monitor, Regshot, HandleDiff, Analysis Automation Tools: Virtual Box, VM Ware, Python , Other Analysis Tools. [10]

**Malware Forensics**

Using TSK for Network and Host Discoveries, Using Microsoft Offline API to Registry Discoveries , Identifying Packers using PEiD, Registry Forensics with Reg Ripper Plu-gins:, Bypassing Poison Ivy's Locked Files, Bypassing Conficker's File System ACL Restrictions, Detecting Rogue PKI Certificates. [9]

**Malware and Kernel Debugging**

Opening and Attaching to Processes, Configuration of JIT Debugger for Shellcode Analysis, Controlling Program Execution, Setting and Catching Breakpoints, Debugging with Python Scripts and Py Commands**,** DLL Export Enumeration, Execution, and Debugging**,** Debugging a VMware Workstation Guest (on Windows)**,** Debugging a Parallels Guest (on Mac OS X). Introduction to WinDbg Commands and Controls, Detecting Rootkits with WinDbgScripts**,** Kernel Debugging with IDA Pro. [9]

**Memory Forensics and Volatility**

Memory Dumping with MoonSols Windows Memory Toolkit**,** Accessing VM Memory Files Overview of Volatility, Investigating Processes in Memory Dumps**,** Code Injection and Extraction**,** Detecting and Capturing Suspicious Loaded DLLs**,** Finding Artifacts in Process Memory**,** Identifying Injected Code with Malfind and YARA. [9]

**Researching and Mapping Source Domains/IPs**

Using WHOIS to Research Domains**,** DNS Hostname Resolution**,** Querying Passive DNS**,** Checking DNS Records**,** Reverse IP Search New Course Form**,** Creating Static Maps**,** Creating Interactive Maps.

**Case Study**

Case study of Finding Artifacts in Process Memory, Identifying Injected Code with Malfind and YARA [8]

**Total Hours: 45**

Text book(s) :

| | |
|---|---|
| 1 | Michael Sikorski, Andrew Honig “Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software” publisher Williampollock |
| 2 | Eldad Eilam, “Reversing: Secrets of Reverse Engineering”, Wiley; 1st edition (April 15, 2005) |
| Reference book(s) : | |
| 1 | Monnappa K A, “Learning Malware Analysis: Explore the concepts, tools, and techniques to analyze and investigate Windows malware”, Packt Publishing (June 29, 2018) |
| 2 | Abhijit Mohanta, Anoop Saldanha, “Malware Analysis and Detection Engineering: A Comprehensive Approach to Detect and Analyze Modern Malware”, Apress; 1st ed. edition (September 23, 2020) |
| 3 | A. P. David, “Ghidra Software Reverse Engineering for Beginners: Analyze, identify, and avoid malicious code and potential threats in your networks and systems”, Packt Publishing (January 8, 2021) |
| 4 | Michael Ligh et al., “Malware Analyst's Cookbook and DVD: Tools and Techniques for Fighting Malicious Code”, Wiley; 1st edition (November 2, 2010) |

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| Department | Computer Science and Engineering | | Programme Code & Name | | | PCS: M.E. Computer Science and Engineering | | |
| **Elective V** | | | | | | | | |
| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E53** | **Image Processing and Analysis** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |
| Objective(s) | • To understand the basics of spatial domain processing<br>• To know about frequency domain processing technoques<br>• To understand the process of segmentation and Edge detection methods<br>• To learn basic image analysis, segmentation, edge detection, and corner Detection, learn morphological operations and texture analysis<br>• To understand the processing of color images , image compression techniques | | | | | | | |
| Course Outcomes | **At the end of the course the student will be able to**<br>• Explore and implement spatial domain processing<br>• Familiar with frequency domain processing tools<br>• Critically analyse different approaches for segmentation and edge detection<br>• Recognize the interest point detection methods, morphological operators and texture analysis<br>• Explore the possibility of applying Image compression techniques in color images | | | | | | | |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Spatial Domain Processing**

Introduction to image processing – imaging modalities – image file formats – image sensing and acquisition – image sampling and quantization – noise models – spatial filtering operations – histograms – smoothing filters – sharpening filters – fuzzy techniques for spatial filtering – spatial filters for noise removal [9]

**Frequency Domain Processing**

Frequency domain – Review of Fourier Transform (FT), Discrete Fourier Transform (DFT), and Fast Fourier Transform (FFT) – filtering in frequency domain – image smoothing – image sharpening – selective filtering – frequency domain noise filters – wavelets – Haar Transform – multiresolution expansions – wavelet transforms – wavelets based image processing [9]

**Segmentation and Edge Detection**

Thresholding techniques – region growing methods – region splitting and merging – adaptive thresholding – threshold selection – global valley – histogram concavity – edge detection – template matching – gradient operators – circular operators – differential edge operators – hysteresis thresholding – Canny operator – Laplacian operator – active contours – object segmentation [9]

**Interest Points, Morphology, and Texture**

Corner and interest point detection – template matching – second order derivatives – median filter based detection – Harris interest point operator – corner orientation – local invariant feature detectors and descriptors – morphology – dilation and erosion – morphological operators – grayscale morphology – noise and morphology – texture – texture analysis – co-occurrence matrices – Laws' texture energy approach – Ade's eigen filter approach [9]

**Color Images and Image Compression**

Color models – pseudo colors – full-color image processing – color transformations – smoothing and sharpening of color images – image segmentation based on color – noise in color images. Image Compression – redundancy in images – coding redundancy – irrelevant information in images – image compression models – basic compression methods – digital image watermarking. [9]

**Total Hours: 45**

Text book(s) :


1. E. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012.
2. W. Burger and M. Burge, “Digital Image Processing: An Algorithmic Introduction using Java”, Springer, 2008.


Reference book(s) :


1. John C. Russ, “The Image Processing Handbook”, Sixth Edition, CRC Press, 2011.
2. R. C. Gonzalez and R. E. Woods, “Digital Image Processing”, Third Edition, Pearson,2008.
3. Mark Nixon and Alberto S. Aquado, “Feature Extraction & Image Processing for Computer Vision”, Third Edition, Academic Press, 2012.
4. D. L. Baggio et al., “Mastering OpenCV with Practical Computer Vision Projects”, Packt Publishing,2012.
5. Jan Erik Solem, “Programming Computer Vision with Python: Tools and algorithms for analyzing images”, O'Reilly Media, 2012.

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| Elective V | | | | | | | | |
| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E54** | **Social Network Analysis** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |
| Objective(s) | • To understand the components of the social network<br>• To model and visualize the social network<br>• To mine the users in the social network<br>• To understand the evolution of the social network<br>• To mine the interest of the user | | | | | | | |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Work on the internals components of the social network<br>2. Model and visualize the social network<br>3. Mine the behaviour of the users in the social network<br>4. Predict the possible next outcome of the social network<br>5. Apply social network in real time applications | | | | | | | |

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**Introduction**

Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis – Key concepts and measures in network analysis - Discussion networks -Blogs and online communities – Web based networks [9]

**Modeling And Visualization**

Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation -Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix-Based Representations- Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data – Random Walks and their Applications –Use of Hadoop and Map Reduce -Ontological representation of social individuals and relationships. [9]

**Mining Communities**

Aggregating and reasoning with social network data, Advanced Representations – Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining -Applications of Community Mining Algorithms - Node Classification in Social Networks. [9]

**Evolution**

Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence – Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks – Expert Location without Graph Constraints - with Score Propagation – Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction – Bayesian Probabilistic Models - Probabilistic Relational Models [9]

**Text and Opinion Mining**

Text Mining in Social Networks -Opinion extraction – Sentiment classification and clustering -Temporal sentiment analysis - Irony detection in opinion mining - Wish analysis - Product review mining – Review Classification – Tracking sentiments towards topics over time Databases in social network , Graph based database, Case study – Twitter/ Facebook [9]

**Total Hours: 45**

Text book(s) :

| | |
|---|---|
| 1 | Charu C. Aggarwal, “Social Network Data Analytics”, Springer; 2011 |
| 2 | Peter Mika, “Social Networks and the Semantic Web”, Springer, 1st edition, 2007. |

Reference book(s) :

| | |
|---|---|
| 1 | Borko Furht, “Handbook of Social Network Technologies and Applications”, Springer, 1st edition, 2010. |
| 2 | Guandong Xu , Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, Springer, 1st edition, 2011. |

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|---|---|
| 3 | Giles, Mark Smith, John Yen, “Advances in Social Network Mining and Analysis”, Springer, 2010. |
| 4 | Ajith Abraham, Aboul Ella Hassanien, Vaclav Snašel, “Computational Social Network Analysis: Trends, Tools and Research Advances”, Springer, 2009. |
| 5 | Toby Segaran, “Programming Collective Intelligence”, O’Reilly, 2012 |

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| Department | Computer Science and Engineering | | Programme Code & Name | | PCS : M.E. Computer Science and Engineering | | | |
| **Elective V** | | | | | | | | |
| Course Code | Course Name | Hours / Week | | Credit | | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E55** | **Web Data Mining** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |
| Objective(s) | • Introduces basic concepts, tasks, methods, and techniques in web mining<br>• Develop an understanding of the web mining process and issues, learn various techniques for data mining<br>• Learn the techniques in solving data mining problems using tools<br>• Know the classification and prediction techniques for web mining<br>• Understand the techniques in solving data mining problems using data mining tools and systems. | | | | | | | |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Gain the knowledge of basic concepts data mining and its functionalities<br>2. Familiar with data mining and knowledge discovery process<br>3. Learn various techniques for web usage mining process and techniques<br>4. Learn classification and prediction algorithms for web data mining<br>5. Apply the techniques in solving data mining problems using data mining tools and systems. | | | | | | | |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**Introduction**

What is Data Mining - Relational Databases - Data Warehouses - Transactional Databases - Advanced Database Systems - Data Mining Functionalities - Interestingness of a pattern Classification of Data Mining Systems - Major issues in Data Mining [9]

**Data Mining And Knowledge Discovery**

The KDD process and methodology - Data preparation for knowledge discovery - Overview of data mining techniques - Market basket analysis - Classification and prediction – Clustering - Memory-based reasoning - Evaluation and Interpretation. [9]

**Web Usage Mining Process And Techniques**

Data collection and sources of data- Data preparation for usage mining - Mining navigational patterns - Integrating e-commerce data - Leveraging site content and structure - User tracking and profiling - E-Metrics: measuring success in e-commerce Privacy issues. [9]

**Classification and Prediction**

Concepts and Issues regarding Classification and Prediction – Classification by Decision Tree Induction – Bayesian Classification - Classification by Back-propagation - Classification Based on Concepts from Association Rule Mining. [9]

**Web Mining Applications and Other Topics**

Data integration for e-commerce - Web personalization and recommender systems - Web content and structure mining - Web data warehousing - Review of tools, applications, and systems. [9]

**Total Hours: 45**

Text book(s) :


1. Michael Berry and Gordon Linoff, “Data Mining Techniques for Marketing, Sales, and Customer Relationship Management”, Second Edition, John Wiley, 2004
2. Ralph Kimball and Richard Merz, “The Data Web house Toolkit”, John Wiley, 2000


Reference book(s) :


1. Bing Liu, “Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data”, Springer; 1st ed. 2007. Corr. 2nd printing edition (30 May 2007)
2. Ian Witten and Eibe Frank, “Data Mining: Practical Machine Learning Tools and Techniques”, 3rd Ed., Morgan Kaufmann, 2011
3. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schutze, “Introduction to Information Retrieval”, Cambridge University Press. 2008.
4. Gordon Linoff and Michael Berry, “Mining the Web: Transforming Customer Data into Customer Value” John Wiley & Sons, 2001.

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| Department | Computer Science and Engineering | | Programme Code & Name | | PCS : M.E. Computer Science and Engineering | | | |
| **Elective VI** | | | | | | | | |
| Course Code | Course Name | Hours / Week | | Credit | | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E61** | **Software Quality Assurance and Testing** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |
| Objective(s) | • To understand the basics of testing, test planning &design and test team organization<br>• To study the various types of test in the life cycle of the software product.<br>• To build design concepts for system testing and execution<br>• To learn the software quality assurance ,metrics, defect prevention techniques<br>• To learn the techniques for quality assurance and applying for applications. | | | | | | | |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Perform functional and nonfunctional tests in the life cycle of the software product.<br>2. Understand system testing and test execution process.<br>3. Gain the knowledge for various system test categories<br>4. Identify defect prevention techniques and software quality assurance metrics.<br>5. Apply techniques of quality assurance for typical applications. | | | | | | | |

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**Software Testing - Concepts, Issues, and Techniques**

Quality Revolution, Verification and Validation, Failure, Error, Fault, and Defect, Objectives of Testing, Testing Activities, Test Case Selection White-Box and Black ,test Planning and design, Test Tools and Automation, . Power of Test. Test Team Organization and Management-Test Groups, Software Quality Assurance Group, System Test Team Hierarchy, Team Building. [8]

**System Testing**

System Testing - System Integration Techniques-Incremental, Top Down Bottom Up Sandwich and Big Bang, Software and Hardware Integration, Hardware Design Verification Tests, Hardware and Software Compatibility Matrix Test Plan for System Integration. Built- in Testing. Functional testing - Testing a Function in Context.

Boundary Value Analysis, Decision Tables. acceptance testing - Selection of Acceptance Criteria, Acceptance Test Plan, Test Execution Test. software reliability - Fault and Failure, Factors Influencing Software, Reliability Models

[10]

**System Test Categories**

System test categories Taxonomy of System Tests, Interface Tests Functionality Tests. GUI Tests, Security Tests Feature Tests, Robustness Tests, Boundary Value Tests Power Cycling Tests Interoperability Tests, Scalability Tests, Stress Tests, Load and Stability Tests, Reliability Tests, Regression Tests, Regulatory Tests.

Test Generation from FSM models- State-Oriented Model. Finite-State Machine Transition Tour Method, Testing with State Verification. Test Architectures-Local, distributed, Coordinated, Remote. System test design- Test Design Factors Requirement Identification, modeling a Test Design Process Test Design Preparedness, Metrics, Test Case Design Effectiveness. System test execution- Modeling Defects, Metrics for Monitoring Test Execution .Defect Reports, Defect Causal Analysis, Beta testing, measuring Test Effectiveness. [11]

**Software Quality**

Software quality - People's Quality Expectations, Frameworks and ISO-9126, McCall's Quality Factors and Criteria – Relationship. Quality Metrics. Quality Characteristics ISO 9000:2000 Software Quality Standard. Maturity models- Test Process Improvement, Testing Maturity Model. [7]

**Software Quality Assurance**

Quality Assurance - Root Cause Analysis, modeling, technologies, standards and methodologies for defect prevention. Fault Tolerance and Failure Containment - Safety Assurance and Damage Control, Hazard analysis using fault-trees and event-trees. Comparing Quality Assurance Techniques and Activities. QA Monitoring and Measurement, Risk Identification for Quantifiable Quality Improvement. Case Study: FSM-Based Testing of Web-Based Applications. [9]

**Total Hours: 45**

Text book(s) :


1 Kshirasagar Nak Priyadarshi Tripathy, "Software Testing And Quality Assurance-Theory and Practice", John Wiley & Sons Inc, First Edition, 2008

| | |
|---|---|
| 2 | Jeff Tian, “Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement”, John Wiley & Sons, Inc., Hoboken, New Jersey. 2005. |
| Reference book(s) : | |
| 1 | Daniel Galin, “Software Quality Assurance - From Theory to Implementation”, Pearson Education Ltd UK, 2004 |
| 2 | Milind Limaye, “Software Quality Assurance”, TMH ,New Delhi, 2011 |
| 3 | Basu Anirban, “Software Quality Assurance, Testing and Metrics”, PHI Learning Private Limited (2 June 2015) |
| 4 | Ivan Mistrik, Richard M Soley, Nour Ali, John Grundy, Bedir Tekinerdogan, “Software Quality Assurance”, Morgan Kaufmann, October 2015 |

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| Department | Computer Science and Engineering | | Programme Code & Name | | PCS : M.E. Computer Science and Engineering | | | |
| **Elective VI** | | | | | | | | |
| Course Code | Course Name | Hours / Week | | Credit | | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E62** | **Smart Sensors and Internet of Things** | 3 | 0 | 0 | 3 | 50 | 50 | 100 |
| Objective(s) | • Able to understand the application areas of IOT<br>• Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks<br>• Able to understand building blocks of Internet of Things and characteristics | | | | | | | |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Understand the vision of IoT from a global context.<br>2. Determine the Market perspective of IoT<br>3. Use of Devices, Gateways and Data Management in IoT.<br>4. Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints<br>5. Building state of the art architecture in IoT | | | | | | | |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked
based on the number of hours notified against each unit in the syllabus**.**

**Environmental Parameters Measurement and Monitoring:** Why measurement and monitoring are important, effects of adverse parameters for the living being for IOT [9]

**Sensors:** Working Principles: Different types; Selection of Sensors for Practical Applications - Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc [10]

**Important Characteristics of Sensors:** Determination of the Characteristics - Fractional order element: Constant Phase Impedance for sensing applications such as humidity, water quality, milk quality – Impedance Spectroscopy: Equivalent circuit of Sensors and Modelling of Sensors - Importance and Adoption of Smart Sensors [13]

**Architecture of Smart Sensors:** Important components, their features Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel

Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor, Usefulness of Silicon Technology in Smart Sensor And Future scope of research in smart sensor

Recent trends in smart sensor for day to day life, evolving sensors and their architecture. [13]

**Total Hours: 45**

Text book(s) :


| | |
|---|---|
| 1 | Yasuura, H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, Springer International Publishing. |
| 2 | Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing. |


Reference book(s) :


| | |
|---|---|
| 1 | Deepak Gupta, Victor Hugo C de Albuquerque, Ashish Khanna, Purnima Lala Mehta, “Smart Sensors for Industrial Internet of Things”, Springer International Publishing, First Edition, 2021. |
| 2 | Vlasios Tsiatsis Stamatis Karnouskos Jan Holler David Boyle Catherine Mulligan, “Internet of Things - Technologies and Applications for a New Age of Intelligence”, Academic Press, 2nd Edition, 2018 |
| 3 | Andrew Minteer, “Analytics for the Internet of Things (IoT): Intelligent analytics for your intelligent devices”, Packt Publishing (July 24, 2017) |
| 4 | Anand Tamboli, “Build Your Own IoT Platform: Develop a Fully Flexible and Scalable Internet of Things Platform in 24 Hours”, Apress; 1st ed. edition (April 30, 2019) |

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| Department | Computer Science and Engineering | Programme Code & Name | | PCS : M.E. Computer Science and Engineering | | | | |
| **Elective VI** | | | | | | | | |
| Course Code | Course Name | Hours / Week | | Credit | | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E63** | **Formal Models of Software Systems** | **3** | **0** | **0** | **3** | **50** | **50** | **100** |

| | |
|---|---|
| Objective(s) | • To understand the goals, complexity of software systems, the role of Specification activities and qualities to control complexity.<br>• To understand the fundamentals of abstraction and formal systems<br>• To learn fundamentals of logic reasoning- Propositional Logic, temporal logic and apply to models systems<br>• To understand formal specification models based on set theory, calculus and algebra and apply to a case study<br>• To learn Z, Object Z and B Specification languages with case studies. |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Recognize the complexity of software systems, the need for formal specifications activities and qualities to control complexity.<br>2. Gain knowledge on fundamentals of abstraction and formal systems<br>3. Learn the fundamentals of logic reasoning- Propositional Logic, temporal logic and apply to models systems<br>4. Develop formal specification models based on set theory, calculus and algebra and apply to a typical case study<br>5. Have working knowledge on Z, Object Z and B Specification languages with case studies. |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**SPECIFICATION FUNDAMENTALS**

Role of Specification- Software Complexity - Size, Structural, Environmental, Application, domain, Communication Complexity, How to Control Complexity. Software specification, Specification Activities- Integrating Formal Methods into the Software Life-Cycle. Specification Qualities- Process Quality Attributes of Formal Specification Languages, Model of Process Quality, Product Quality and Utility, Conformance to Stated Goals Quality Dimensions and Quality Model. [9]

**FORMAL METHODS**

Abstraction- Fundamental Abstractions in Computing. Abstractions for Software Construction. Formalism Fundamentals - Formal Systems, Formalization Process in Software Engineering Components of a Formal System- Syntax, Semantics, and Inference Mechanism. Properties of Formal Systems - Consistency. Automata-Deterministic Finite Accepters, State Machine Modeling Nondeterministic Finite Accepters, Finite State Transducers Extended Finite State Machine. Case Study—Elevator Control. Classification of C Methods- Property-Oriented Specification Methods, Model-Based Specification Techniques. [9]

**LOGIC**

Propositional Logic - Reasoning Based on Adopting a Premise, Inference Based on Natural Deduction. Predicate Logic - Syntax and Semantics, Policy Language Specification, knowledge Representation Axiomatic Specification. Temporal Logic -.Temporal Logic for Specification and Verification, Temporal Abstraction Propositional Temporal Logic (PTL), First Order Temporal Logic (FOTL).Formal Verification, Verification of Simple FOTL, Model Checking, Program Graphs, Transition Systems. [9]

**SPECIFICATION MODELS**

Mathematical Abstractions for Model-Based Specifications-Formal Specification Based on Set Theory, Relations and Functions. Property-Oriented Specifications- Algebraic Specification, Properties of Algebraic Specifications, Reasoning, Structured Specifications. Case Study—A Multiple Window Environment:

requirements, Modeling Formal Specifications. Calculus of Communicating Systems: Specific Calculus for Concurrency. Operational Semantics of Agents, Simulation and Equivalence, Derivation Trees, Labeled Transition Systems. [9]

**FORM ALLANGUAGES**

The Z Notation, abstractions in Z, Representational Abstraction, Types, Relations and Functions, Sequences, Bags. Free Types-Schemas, Operational Abstraction -Operations Schema Decorators, Generic Functions, Proving Properties from Z specifications, Consistency of Operations. Additional Features in Z. Case Study: An Automated Billing System. The Object-Z Specification Language- Basic Structure of an Object-Z, Specification. Parameterized Class, Object-Orientation, composition of Operations-Parallel Communication Operator, Nondeterministic Choice Operator, and Environment Enrichment. The B-Method -Abstract Machine Notation (AMN), Structure of a B Specification, arrays, statements. Structured Specifications, Case Study- A Ticketing System in a Parking. [9]

**Total Hours: 45**

Text book(s) :


| | |
|---|---|
| 1 | M.Ben-Ari, “Mathematical Logic for computer science”, second edition, Springer, 2003. |
| 2 | Logic in Computer Science- modeling and reasoning about systems, 2 nd Edition, Cambridge University Press, 2004. |


Reference book(s) :


| | |
|---|---|
| 1 | V.S. Alagar, K. Periyasamy, David Grises and Fred B Schneider, “Specification of Software Systems”, Springer –Verlag London, 2011 |
| 2 | Jonathan Jacky, “The ways Z: Practical programming with formal methods”, Cambridge University Press,1996. |
| 3 | Jim Woodcock and Jim Devies , “Using Z-Specification Refinement and Proof”, Prentice Hall, 1996 |
| 4 | Antoi Diller, “Z: An introduction to formal methods”, Second Edition, Wiley, 1994. |

| K.S.Rangasamy College of Technology - Autonomous Regulation | | | | | | | | R 2018 |
|---|---|---|---|---|---|---|---|---|
| Department | Computer Science and Engineering | Programme Code & Name | | PCS : M.E. Computer Science and Engineering | | | | |
| **Elective VI** | | | | | | | | |
| Course Code | Course Name | Hours / Week | | Credit | | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E64** | **Performance Analysis of Computer Systems** | **3** | **0** | **0** | **3** | **50** | **50** | **100** |

| | |
|---|---|
| Objective(s) | • To know the mathematical foundations needed for performance evaluation of computer systems<br>• To recognize the metrics used for performance evaluation<br>• To apprehend the analytical modeling of computer systems<br>• To enable the students to develop new queueing analysis for both simple and complex systems<br>• To appreciate the use of smart scheduling and introduce the students to analytical techniques for evaluating scheduling policies |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Identify the need for performance evaluation and the metrics used for it<br>2. Discuss open and closed queueing networks<br>3. Define Little'e law and other operational laws<br>4. Apply the operational laws to open and closed systems<br>5. Use discrete-time and continuous-time Markov chains to model real world systems and develop analytical techniques for evaluating scheduling policies |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**OVERVIEW OF PERFORMANCE EVALUATION**

Need for Performance Evaluation in Computer Systems –Overview of Performance Evaluation Methods – Introduction to Queueing –Probability Review –Generating Random Variables for Simulation –Sample Paths, Convergence and Averages –Little's Law and other Operational Laws –Modification for Closed Systems. [9]

**MARKOV CHAINS AND SIMPLE QUEUES**

Discrete-Time Markov Chains –Ergodicity Theory –Real World Examples –Google, Aloha –Transition to Continuous-Time Markov Chain –M/M/1 and PASTA. [9]

**MULTI-SERVER AND MULTI-QUEUE SYSTEMS**

Server Farms: M/M/k and M/M/k/k –Capacity Provisioning for Server Farms –Time Reversibility and Burke's Theorem –Networks of Queues and Jackson Product Form –Classed and Closed Networks of Queues. [9]

**REAL-WORLD WORKLOADS**

Case Study of Real-world Workloads –Phase-Type Distributions and Matrix-Alalytic Methods –Networks with Time-Sharing Servers –M/G/1 Queue and the Inspection Paradox –Task Assignment Policies for Server Farms. [9]

**SMART SCHEDULING IN THE M/G/1**

Performance Metrics –Scheduling Non-Preemptive and Preemptive Non-Size-Based Policies -. Scheduling Non-Preemptive and Preemptive Size-Based Policies –Scheduling -SRPT and Fairness. [9]

**Total Hours: 45**

Text book(s) :


| | |
|---|---|
| 1 | Mor Harchol -Balter, "Performance Modeling and Design of Computer Systems –Queueing Theory in Action", Cambridge University Press, 2013. |
| 2 | Raj Jain, "The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation and Modeling", Wiley-Interscience, 1991. |


Reference book(s) :


| | |
|---|---|
| 1 | Lieven Eeckhout, "Computer Architecture Performance Evaluation Methods", Morgan and Claypool Publishers, 2010. |
| 2 | Paul J. Fortier and Howard E. Michel, "Computer Systems Performance Evaluation and Prediction", Elsevier, 2003. |
| 3 | David J. Lilja, "Measuring Computer Performance: A Practitioner's Guide", Cambridge University Press,2000 |
| 4 | Krishna Kant, "Introduction to Computer System Performance Evaluation", McGraw-Hill, 1992. |
| 5 | K. S. Trivedi, "Probability and Statistics with Reliability, Queueing and Computer Science Applications", John Wiley and Sons, 2001. |

| K.S.Rangasamy College of Technology - Autonomous Regulation | | | | | | | | R 2018 |
|---|---|---|---|---|---|---|---|---|
| Department | Computer Science and Engineering | Programme Code & Name | | PCS : M.E. Computer Science and Engineering | | | | |
| **Elective VI** | | | | | | | | |
| Course Code | Course Name | Hours / Week | | Credit | | Maximum Marks | | |
| | | L | T | P | C | CA | ES | Total |
| **50 PCS E65** | **Language Technologies** | **3** | **0** | **0** | **3** | **50** | **50** | **100** |

| | |
|---|---|
| Objective(s) | • To learn the fundamentals of language features<br>• To know the speech synthesis and speech recognition techniques<br>• To understand the syntax of a language and parsing techniques<br>• To learn the semantics and pragmatics of a language<br>• To identify the applications of information extraction and machine translation |
| Course Outcomes | **At the end of the course the student will be able to**<br>1. Tag a given text with basic Language features<br>2. Design an innovative application using NLP components<br>3. Implement a rule based system to tackle morphology/syntax of a language<br>4. Design a tag set to be used for semantics and pragmatics of a language<br>5. Compare and contrast use of different statistical approaches for different types of NLP applications. |

**Note:** Hours notified against each unit in the syllabus are only indicative but are not decisive. Faculty may decide the number of hours for each unit depending upon the concepts and depth. Questions need not be asked based on the number of hours notified against each unit in the syllabus**.**

**INTRODUCTION**

Words -Regular Expressions and Automata -Words and Transducers -N-grams -Part-of-Speech –Tagging - Hidden Markov and Maximum Entropy Models. [9]

**SPEECH**

Speech –Phonetics -Speech Synthesis -Automatic Speech Recognition -Speech Recognition: -Advanced Topics -Computational Phonology. [9]

**SYNTAX**

Formal Grammars of English -Syntactic Parsing -Statistical Parsing -Features and Unification -Language and Complexity. [9]

**SEMANTICS AND PRAGMATICS**

The Representation of Meaning -Computational Semantics -Lexical Semantics -Computational Lexical Semantics -Computational Discourse. [9]

**APPLICATIONS**

Information Extraction -Question Answering and Summarization -Dialogue and Conversational Agents - Machine Translation [9]

**Total Hours: 45**

Text book(s) :


| | |
|---|---|
| 1 | Breck Baldwin, "Language Processing with Java and LingPipe Cookbook", Atlantic Publisher, 2015. |
| 2 | Daniel Jurafsky, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech", Pearson Publication, 2014. |


Reference book(s) :


| | |
|---|---|
| 1 | Nitin Indurkhya and Fred J. Damerau, "Handbook of Natural Language Processing", Second Edition, Chapman and Hall/CRC Press, 2010. |
| 2 | Richard M Reese, "Natural Language Processing with Java", O Reilly Media, 2015. |
| 3 | Steven Bird, Ewan Klein and Edward Loper, -"Natural Language Processing with Python", First Edition, O Reilly Media, 2009. |
| 4 | James Allen, ”Natural Language Understanding”, Pearson Education; 2nd edition (1 January 2002) |

| K.S.Rangasamy College of Technology – Autonomous R2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 50 AT 001 ENGLISH FOR RESEARCH PAPER WRITING | | | | | | | | |
| Common to all Branches | | | | | | | | |
| **Semester** | **Hours / Week** | | | **Total hrs** | **Credit** | **Maximum Marks** | | |
| | **L** | **T** | **P** | | **C** | **CA** | **ES** | **Total** |
| **I/II** | 2 | 0 | 0 | 30 | - | 100 | - | 100 |

| | |
|---|---|
| Objectives | • To know how to improve your writing skills and level of readability<br>• To learn about what to write in each section<br>• To gain the skills needed when writing a Title<br>• To improve research paper writing skills<br>• 5. To enhance the knowledge on plagiarism while writing papers |
| Course Outcomes | **Students will be able to:**<br>1. Gain an introductory knowledge of the some of the issues explored in influential works of the English-language tradition,<br>2. Explain some of the stylistic strategies writers have used to explore those issues.<br>3. Read complex texts actively: recognize key passages; raise questions;<br>4. Describe complexity and ambiguity; comprehend the literal and figurative<br>5. Ability to uses of language. |

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness [5]

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction [5]

3Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check. [5]

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, [5]

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 [5]

useful phrases, how to ensure paper is as good as it could possibly be the first- time submission [5]
**Total Hours [30]**

**Text book:**

| | |
|---|---|
| 1 | R Goldbort “Writing for Science:, Yale University Press 2006 |
| 2 | R Day “How to Write and Publish a Scientific Paper”, Cambridge University Press, 2006. |

**Reference Books**

| | |
|---|---|
| 1 | N Highman “Handbook of Writing for the Mathematical Sciences”, SIAM. Highman’sbook.1999. |
| 2 | Adrian Wallwork, “English for Writing Research Papers:, Springer New York Dordrecht Heidelberg London, 2011 |
| 3 | Singh Bhakar, “Hand Book for Writing Research Paper”, Bharati Publications, New Delhi, 2014. |
| 4 | Steven D. Krause, “The Process of Research Writing”, Steven D. Krause Publisher, 2004 |

| K.S. Rangasamy College of Technology – Autonomous R 2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 AT 002 DISASTER MANAGEMENT** | | | | | | | | |
| **Common to all Branches** | | | | | | | | |
| **Semester** | **Hours / Week** | | | **Total hrs** | **Credit** | **Maximum Marks** | | |
| | **L** | **T** | **P** | | **C** | **CA** | **ES** | **Total** |
| **I/II** | 2 | 0 | 0 | 30 | - | 100 | - | - |

| | |
|---|---|
| Objectives | • Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.<br>• Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.<br>• To understand approaches of Disaster Management<br>• Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.<br>• Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in |
| Course Outcomes | **At the end of the course the students will be able to:**<br>1. Understand the various hazards<br>2. Analyze the situation during hazards and take necessary steps for protection<br>3. Know the risks involved in natural disaster<br>4. Apply the knowledge of risk assessment and protect the public<br>5. Create awareness about disaster and its management techniques among public |

**Introduction** [5]

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

**Repercussions of Disasters and Hazards**: [5]

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.

**Disaster Prone Areas in India** [5]

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

**Disaster Preparedness and Management** [5]

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.

**Risk Assessment** [5]

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.

**Disaster Mitigation** [5]

Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

**Text book:**


| | |
|---|---|
| 1 | R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company. |
| 2 | Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi. |


**Reference(s):**


| | |
|---|---|
| 1 | Damon Coppola, **Introduction to International Disaster Management 3rd Edition,** Butterworth-Heinemann , **Published Date:** 28th January 2015. |
| 2 | Goel S. L., Disaster Administration And Management Text And Case Studies",Deep &Deep Publication Pvt. Ltd., New Delhi. |
| 3 | Gupta A.K., Niar S.S and Chatterjee S. (2013) Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, Delhi. |
| 4 | Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi. |

| K.S.Rangasamy College of Technology – Autonomous R2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 AT 003 - SANSKRIT FOR TECHNICAL KNOWLEDGE** | | | | | | | | |
| **Common to all Branches** | | | | | | | | |
| **Semester** | **Hours / Week** | | | **Total hrs** | **Credit** | **Maximum Marks** | | |
| | **L** | **T** | **P** | | **C** | **CA** | **ES** | **Total** |
| I/II | 2 | 0 | 0 | 30 | - | 100 | - | 100 |
| **Objective(s)** | • To get a working knowledge in illustrious Sanskrit, the scientific language in the world.<br>• To improve brain functioning<br>• To develop the logic in mathematics, science & other subjects enhancing the memory power<br>• To explore the huge knowledge from ancient literature<br>• To inculcate technical knowledge on Sanskrit | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>1. Know the basic Sanskrit language.<br>2. Explain an ancient Sanskrit literature about science & technology.<br>3. Develop logical skill among the group.<br>4. Speak and write Sanskrit language<br>5. Describe the technical concepts of engineering | | | | | | | |

**Basics of Sanskrit**

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences. [10]

**Sanskrit Literature**

Order, Introduction of roots, Technical information about Sanskrit Literature. [10]

**Technical Concepts in Engineering**

Technical concepts of Engineering-Electrical, Mechanical,Architecture, Mathematics. [10]

**Total Hours: [30]**

**Text book (s) :**

| | |
|---|---|
| 1 | Dr.Vishwas, Abhyaspustakam" – Samskrita-Bharti Publication, New Delhi. 2014 |
| 2 | PrathamaDeeksha-VempatiKutumbshastri, "Teach Yourself Sanskrit" Rashtriya SanskritSansthanam, New Delhi Publication.2016 |

**Reference(s) :**

| | |
|---|---|
| 1 | Suresh Soni, "India's Glorious Scientific Tradition" Ocean books (P) Ltd., New Delhi.2007 |
| 2 | S. Venkitasubramonia Iyer, "Technical Literature in Sanskrit, Volume 10", University of Kerala, 1997 |
| 3 | Kaviraj Gopinath, "The Sandilya Sanhita Bhaktikhanda", Publisher: Nabu Press, 2016 |
| 4 | Khmer Bible, "Sanskrit textbook rewrites the script on modern science", Cambodia Press, 2019. |

| K.S.Rangasamy College of Technology – Autonomous R2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 50 AT 004 VALUE EDUCATION | | | | | | | | |
| Common to all Branches | | | | | | | | |
| **Semester** | **Hours / Week** | | | **Total hrs** | **Credit** | **Maximum Marks** | | |
| | **L** | **T** | **P** | | **C** | **CA** | **ES** | **Total** |
| **I/II** | 2 | 0 | 0 | 30 | - | 100 | - | 100 |

| | |
|---|---|
| Objectives | • To know value of education and self- development<br>• To Imbibe good values in students<br>• To let the should know about the importance of character<br>• To gain knowledge on moral values<br>• To inculcate the habit of ethics and behaviour |
| Course Outcomes | **Students will be able to:**<br>1. Explain about knowledge of self-development<br>2. Describe lthe importance of Human values<br>3. Develop the overall personality<br>4. Ability to work with ethics in work place<br>5. Demonstrate moral values and behaviour in practice |

- Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.
- Moral and non- moral valuation. Standards and principles.
- Value judgements [5]

- Importance of cultivation of values.
- Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness.
- Honesty, Humanity. Power of faith, National Unity.
- Patriotism. Love for nature, Discipline [5]

- Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking.
- Integrity and discipline.
- Punctuality, Love and Kindness.
- Avoid fault Thinking.
- Free from anger, Dignity of labour.
- Universal brotherhood and religious tolerance.
- True friendship.
- Happiness Vs suffering, love for truth.
- Aware of self-destructive habits.
- Association and Cooperation.
- Doing best for saving nature [10]

- Character and Competence –Holy books vs Blind faith.
- Self-management and Good health.
- Science of reincarnation.
- Equality, Non violence, Humility, Role of Women.
- All religions and same message.
- Mind your Mind, Self-control.
- Honesty, Studying effectively [10]

Total Hours: [30]

**Text book:**

| | |
|---|---|
| 1 | S K Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi 2016 |
| 2 | D N Ghose, “A Textbook of Value Education”. Dominant Publishers, 2005 |

**Reference Books:**

| | |
|---|---|
| 1 | N. Venkataiah, “Value Education”, APH Publishing, 1998 |
| 2 | N. Venkataiah, “Research in Value Education”, APH Publishing, 1996 |
| 3 | R. P. Shukla, “Value education and human rights”, Sarup & Sons, 2004 |
| 4. | Satya Pal Ruhela, “The Emerging Concept of Education in Human Values”, Daya Books, 1996 |

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|---|---|---|---|---|---|---|---|---|
| **50 AT 005 PEDAGOGY STUDIES** | | | | | | | | |
| **Common to all Branches** | | | | | | | | |
| **Semester** | **Hours / Week** | | | **Total hrs** | **Credit** | **Maximum Marks** | | |
| | **L** | **T** | **P** | | **C** | **CA** | **ES** | **Total** |
| **I/II** | 2 | 0 | 0 | 30 | - | 100 | - | 100 |
| Objectives | • To understand the language background of students.<br>• To learnt about the nature of classroom discourse.<br>• To describe the nature and need of informational reading.<br>• To analyse content areas and to write.<br>• To understand the importance and role of language for content areas. | | | | | | | |
| Course Outcomes | **At the end of the course the students will be able to:**<br>1. Develop and document their own personal learning network<br>2. Create a concept map to identify layers of understanding<br>3. Develop a project-based lesson plan that emphasizes student exploration, interaction, creation, and feedback cycles<br>4. Compare strengths and weaknesses of online tools and methods<br>5. Articulate a personal philosophy for teaching and learning | | | | | | | |

- **Introduction and Methodology:**
- Aims and rationale, Policy background, Conceptual framework and terminology
- Theories of learning, Curriculum, Teacher education.
- Conceptual framework, Research questions**.**
- Overview of methodology and Searching.
- Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.
- Curriculum, Teacher education.
- Evidence on the effectiveness of pedagogical practices
- Methodology for the in depth stage: quality assessment of included studies.
- How can teacher education (curriculum and practicum) and the school curriculum and
- guidance materials best support effective pedagogy?
- Theory of change.
- Strength and nature of the body of evidence for effective pedagogical practices.
- Pedagogic theory and pedagogical approaches.
- Teachers' attitudes and beliefs and Pedagogic strategies.
- Professional development: alignment with classroom practices and follow-up support
- Peer support
- Support from the head teacher and the community.
- Curriculum and assessment
- Barriers to learning: limited resources and large class sizes
- **Research gaps and future directions**
- Research design
- Contexts
- Pedagogy
- Teacher education
- Curriculum and assessment
- Dissemination and research impact.

Total Hours [30]

**Text book:**


| | |
|---|---|
| 1 | Anderson, T., & Elloumi, F. (Eds.). (2008). *Theory and practice of online learning (*2nd ed*.)* Athabasca, AB, Canada: Athabasca University. |
| 2 | Fink, L. D. (2013). *Creating significant learning experiences: An integrated approach to designing college courses*. SanFrancisco, CA: Jossey-Bass.. |


**Reference Books:**


| | |
|---|---|
| 1 | Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID. |
| 2 | Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282. |
| 3 | Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston:Blackwell. |
| 4 | Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign. |

| K.S.Rangasamy College of Technology – Autonomous R2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **50 AT 006 - STRESS MANAGEMENT BY YOGA** | | | | | | | | |
| **Common to all Branches** | | | | | | | | |
| **Semester** | **Hours / Week** | | | **Total hrs** | **Credit** | **Maximum Marks** | | |
| | **L** | **T** | **P** | | **C** | **CA** | **ES** | **Total** |
| I/II | 2 | 0 | 0 | 30 | - | 100 | - | 100 |

| | |
|---|---|
| **Objective(s)** | • To gain knowledge on overall health of body and mind.<br>• To know how to overcome stress.<br>• To inculcate the habit of yoga practice<br>• To perform yoga excerises<br>• To manage stress at work place |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>1. Develop healthy mind in a healthy body<br>2. Improve social health<br>3. Ability to prove their efficiency<br>4. Handle stress at work places<br>5. Practice yoga exercise |

1. Definitions of Eight parts of yoga. ( Ashtanga ) [10]

2. **Yam and Niyam**.

Do`s and Don't's in life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha

ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan [10]

**3. Asan and Pranayam**

i) Various yog poses and their benefits for mind & body

ii) Regularization of breathing techniques and its effects-Types of pranayama [10]

Total Hours: [30]

**Text Books:**

| | |
|---|---|
| 1 | Yogic Asanas for Group Training-Part-I", Janardan Swami YogabhyasiMandal, Nagpur.2016 |
| 2 | "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama(Publication Department), Kolkata. 2018 |

**Reference Books:**

| | |
|---|---|
| 1 | Acharya Yatendra, "Yoga & Stress Management", The Picnic Basket 2019 |
| 2 | Swami Shivapremananda, "Yoga for Stress Relief: A Simple and Unique Three-Month Program for De-Stressing and Stress Prevention", Random House; 1st edition , January 20, 1998. |
| 3 | K. N. Udupa, "Stress and Its Management by Yoga", Motilal Banarsidass Publ., 1985 |
| 4 | K. N. Udupa, "Disorders of Stress and Their Management by Yoga: A Study of Neurohumoral Response", Banaras Hindu University, 1978. |

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|---|---|---|---|---|---|---|---|---|
| **50 AT 007 - PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS** | | | | | | | | |
| **Common to all Branches** | | | | | | | | |
| **Semester** | **Hours / Week** | | | **Total hrs** | **Credit** | **Maximum Marks** | | |
| | **L** | **T** | **P** | | **C** | **CA** | **ES** | **Total** |
| I/II | 2 | 0 | 0 | 30 | - | 100 | - | 100 |
| **Objective(s)** | • To learn to achieve the highest goal happily.<br>• To become a person with stable mind, pleasing personality and determination.<br>• To awaken wisdom in students.<br>• To inculcate the habit of personality development<br>• To gain knowledge on life skills | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>1. Develop versatile personality.<br>2. Achieve the highest goal in life by developing personality.<br>3. Lead the nation and mankind to peace and prosperity.<br>4. Ability to improve life skills<br>5. Explain about work culture in work place | | | | | | | |

**Neetisatakam -Holistic development of personality**
Verses- 19,20,21,22 (wisdom)
Verses- 29,31,32 (pride & heroism)
Verses- 26,28,63,65 (virtue)
Verses- 52,53,59 (dont's)
Verses- 71,73,75,78 (do's) [10]

Approach to day to day work and duties.
ShrimadBhagwadGeeta : Chapter 2-Verses 41, 47,48,
Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
Chapter 18-Verses 45, 46, 48. [10]

Statements of basic knowledge.
ShrimadBhagwadGeeta: Chapter2-Verses 56, 62, 68
Chapter 12 -Verses 13, 14, 15, 16,17, 18
Personality of Role model. ShrimadBhagwadGeeta:
Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
Chapter 4-Verses 18, 38,39
Chapter18 – Verses 37,38,63 [10]
Total Hours: [30]

**Text Books :**


| | |
|---|---|
| 1 | Swami Swarupananda "Srimad Bhagavad Gita" Advaita Ashram PublicationDepartment), Kolkata, 2016 |
| 2 | P.Gopinath,Rashtriya, Bhartrihari's Three Satakam (Niti-sringar-vairagya) SanskritSansthanam, New Delhi. 2015 |


**Reference Books:**


| | |
|---|---|
| 1 | Sagir Ahmed, "Enlightenment: Personality Development & Management", Mind & Body Philosophy eBooks, 2015 |
| 2 | S.K Chakroborty,. "Valuesand Ethics for organizations Theory and practice", OxfordUniversity Press, New Delhi, 2018 |
| 3 | Prashant Kumar Nayak, "Personality Development Through Life Enlightenment Skills", Springer, 2010 |
| 4 | Saroj Hiremath, "Life skills and Personality Development", Sage Publisher 2016 |

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|---|---|---|---|---|---|---|---|---|
| **50 AT 008 - CONSTITUTION OF INDIA** | | | | | | | | |
| **Common to all Branches** | | | | | | | | |
| **Semester** | **Hours / Week** | | | **Total hrs** | **Credit** | **Maximum Marks** | | |
| | **L** | **T** | **P** | | **C** | **CA** | **ES** | **Total** |
| I/II | 2 | 0 | 0 | 30 | - | 100 | - | 100 |

| | |
|---|---|
| **Objective(s)** | • To know the premises informing the twin themes of liberty and freedom from a civil rights perspective.<br>• 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.<br>• To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.<br>• To gain knowledge on bill passing<br>• To acquire knowledge on function of election commission |
| **Course Outcomes** | **At the end of the course the students will be able to:**<br>1. Discuss the growth of the demand for civil rights in India for the bulk of fns before the arrival of Gandhi in Indian politics.<br>2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.<br>3. 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.<br>4. Discuss the passage of the Hindu Code Bill of 1956.<br>5. Explain the functions of Election Commission |

**History of Making of the Indian Constitution:**
History - Drafting Committee, ( Composition & Working) [5]

**Philosophy of the Indian Constitution:**
Preamble - Salient Features [5]

**Contours of Constitutional Rights & 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. [5]

**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. [5]

**Local Administration:**
District's Administration head: Role and Importance, - Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation - Pachayati raj: Introduction, PRI: Zila Pachayat - 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. [5]

**Election Commission:**
Election Commission: Role and Functioning- Chief Election Commissioner and Election Commissioners- State Election Commission: Role and Functioning- Institute and Bodies for the welfare of SC/ST/OBC and Women. [5]

**Total Hours [30]**

**Text Book:**

| | |
|---|---|
| 1 | The Constitution of India, 1950 (Bare Act), Government Publication |
| 2 | S.N, Busi, Ambedkar, B.R.,"Framing of Indian Constitution", 1st Edition, 2015. |

**Reference(s):**

| | |
|---|---|
| 1 | Basu, D D., "Introduction to the Constitution of India", Lexis Nexis, 2015. |
| 2 | M.P Jain, "Indian Constitution Law", 7th Edition, Lexis Nexis, 2014. |
| 3 | S R Bhansali, Textbook on The Constitution of India, Universal Publishers, 2015 |
| 4 | M P Jain, Outlines of Indian Legal and Constitutional History, Lexisnexis, 2014 |

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| **50 AT 009 - Research Ethics** | | | | | | | | |
| **Common to all Branches** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| III | 1 | 0 | 0 | 15 | 0 | 100 | - | 100 |

| | |
|---|---|
| **Objective(s)** | • Analyze the ethical practices in research<br>• Familiarize about research and documentation<br>• Enlighten about collaborative research<br>• Aware about publication ethics |
| **Course Outcomes** | **At the end of the course, the student will be able to**<br>CO1: Comprehend the importance of ethical practices in research.<br>CO2: Distinguish ethical practices from unethical practices in Research Design.<br>CO3: Understand ethical practices in conducting research and its dissemination. |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Introduction to Ethical Practice in Research** [2]
Values Underlying Research Integrity; Framework for Good Academic Research Practices

**Ethics in Research Design & Conducting Research** [5]
Planning; Research Questions and Documentation ; Literature Review; Data Precision, Accuracy & errors, Research Execution, Documentation & Manuscript writing; Checks for Plagiarism, Falsification, Fabrication, and Misrepresentation.

**Collaborative Research & IPR** [5]
Collaboration and Authorship; Sharing of Credits; Intellectual Property

**Dissemination** [3]
Selection of the Right Medium for Publication; Choosing the Right Journal for Publication; Translation of Research

**Total Hours 15**

**Text Book(s):**


1. Guidance Document: Good Academic Research Practices. New Delhi: University Grants Commission, Sep 2020 (https://www.ugc.ac.in/e-book/grap_29092020/mobile/index.html)
2. UGC Regulation: Promotion of Academic Integrity and Prevention of Plagiarism in HEI's, Regulation 2018 (https://www.ugc.ac.in/pdfnews/7771545_academic-integrity-Regulation2018.pdf)


**Reference(s):**


1. Muralidhar, K., Ghosh, A., &Singhvi, A. K. (2019). Ethics in Science Education, Research and Governance. ISBN: 978-81-939482-1-7 (https://www.insaindia.res.in/pdf/Ethics_Book.pdf)
2. Griffiths, P. A., McCormick Adams, R., Albertis, B. M., Blout, E. R., Browder, F. E., Challoner, M. D., & Stine, D. D. (1995). On being a scientist: responsible conduct in research. Washington (DC): National Academy
3. Steven D. Krause (2007) Process of Research writing (Open Textbook Library, University of Michigan)
4. Chery Lowry (2016) Choosing & Using sources: A guide to academic research (Open Textbook Library, University of Michigan)