**SYLLABUS**

**FOR**

**TWO-YEAR M. TECH. PROGRAMME**

**IN**

**INFORMATION TECHNOLOGY**



|  |
| --- |
| **NAAC – A Grade** |

**DEPARTMENT OF INFORMATION TECHNOLOGY**

**COLLEGE OF ENGINEERING & TECHNOLOGY**

**(An Autonomous and Constituent College of BPUT, Odisha)**

**Techno Campus, Mahalaxmi Vihar, Ghatikia,**

**Bhubaneswar-751029, Odisha, INDIA**

[**www.cet.edu.in**](http://www.cet.edu.in)

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**COURSE: M. Tech. (IT – Information Technology), Duration: 2 years (Four Semesters)**

**Abbreviations Used: U= UG, I= Integrated, P= PG**

**PC= Professional Core PE= Professional Elective OE= Open Elective**

**LC= Lab Course MC= Mandatory Course AC= Audit Course**

**L= Lectures P= Practical/Laboratory IA\*= Internal Assessment**

**T= Tutorial PA= Practical Assessment EA=End-Semester Assessment**

**\*Internal Assessment Max. Mark (30 marks) consists of Mid Semester (20 marks) and Quiz+Assignment (10 marks)**

**Subject Code Format:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| **Prog (U/I/P)** | **Type (PC/PE/OE/LC/MC/AC)** | **Department (CE/EE/IE/ME/…)** | **Semester (1/2/…/0)** | **Serial No. (1/2/3/…/99)** |

**1st SEMESTER**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl. No.** | **Subject** **Type** | **Subject Code** | **Subject****Name** | **Teaching Hours** | **Credit** | **Maximum Marks** |
| **L** | **T** | **P** | **IA** | **EA** | **PA** | **Total** |
| 1 | Core 1 | PPCIT101 | Data Mining | 3 | 0 | 0 | 3 | 30 | 70 | - | 100 |
| 2 | Core 2 | PPCIT102 | Advanced Algorithm Design | 3 | 0 | 0 | 3 | 30 | 70 | - | 100 |
| 3 | Professional Elective 1(Any One) | PPEIT101 | Computational Intelligence | 3 | 0 | 0 | 3 | 30 | 70 | - | 100 |
| PPEIT102 | Wireless Sensor Network  |
| PPECS101 | Internet of Things |
| PPEIT103 | Advanced Database Systems  |
| 4 | Professional Elective 2(Any One) | PPEIT104 | Information Theory and Coding Techniques  | 3 | 0 | 0 | 3 | 30 | 70 | - | 100 |
| PPEIT105 | Internet Programming  |
| PPEIT106 | Information Security & Cyber Laws |
| PPECS105 | Cloud Computing  |
| 5 | Mandatory  | PMCMH101 | Research Methodology & IPR  | 2 | 0 | 0 | 2 | 30 | 70 | - | 100 |
| 6 | Lab 1 | PLCIT101 | Advanced Data Structures & Algorithms Lab | 0 | 0 | 4 | 2 | - | - | 100 | 100 |
| 7 | Lab 2 | PLCIT102 | Computing Lab-I | 0 | 0 | 4 | 2 | - | - | 100 | 100 |
| **Total** | **14** | **0** | **8** | **18** | **150** | **350** | **200** | **700** |
| 8 | Audit 1 | Any one subject from Appendix-I | 100 |
| **Grand Total** | **800** |

**2nd SEMESTER**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl. No.** | **Subject** **Type** | **Subject Code** | **Subject****Name** | **Teaching Hours** | **Credit** | **Maximum Marks** |
| **L** | **T** | **P** | **IA** | **EA** | **PA** | **Total** |
| 1 | Core 3 | PPCIT201 | Software Engineering  | 3 | 0 | 0 | 3 | 30 | 70 | - | 100 |
| 2 | Core 4 | PPCIT202 | Mobile Computing | 3 | 0 | 0 | 3 | 30 | 70 | - | 100 |
| 3 | Professional Elective 3(Any One) | PPEIT201 | Network and System Security  | 3 | 0 | 0 | 3 | 30 | 70 | - | 100 |
| PPEIT202 | Advanced Computer Architecture |
| PPEIT203 | Fault Tolerant system  |
| PPECS208 | Soft Computing |
| 4 | Professional Elective 4(Any One) | PPEIT204 | Service Oriented Architecture | 3 | 0 | 0 | 3 | 30 | 70 | - | 100 |
| PPEIT205 | Big Data Analytics |
| PPEIT206 | Information Retrieval |
| PPECS207 | Digital Forensics |
| 5 | Practical 1 | PPRIE101 | Mini Project with Seminar | 0 | 0 | 4 | 2 | - | - | 100 | 100 |
| 6 | Lab 3 | PLCIT201 | Software Engineering Lab | 0 | 0 | 3 | 2 | - | - | 100 | 100 |
| 7 | Lab 4 | PLCIT202 | Computing Lab-II | 0 | 0 | 4 | 2 | - | - | 100 | 100 |
| **Total** | **12** | **0** | **12** | **18** | **120** | **280** | **300** | **700** |
| 8 | Audit 2 | Any one subject from Appendix-II | 100 |
| **Grand Total** | **800** |

**3rd SEMESTER**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl. No.** | **Subject** **Type** | **Subject Code** | **Subject****Name** | **Teaching Hours** | **Credit** | **Maximum Marks** |
| **L** | **T** | **P** | **IA** | **EA** | **PA** | **Total** |
| 1 | Professional Elective 5(Any One) | PPECS301 | Software Testing | 3 | 0 | 0 | 3 | 30 | 70 | - | 100 |
| PPEIE303 | Digital Image processing |
| PPEIT301 | Real Time Systems  |
| PPEIT302 | Intrusion Detection System  |
| 2 | Open Elective  | Any one subject from Appendix-III | 3 | 0 | 0 | 3 | 30 | 70 | - | 100 |
| 3 | Project 1 | PPRIT301 | Phase-I Dissertation | 0 | 0 | 20 | 10 | - | - | 100 | 100 |
| **Total** | **6** | **0** | **20** | **16** | **60** | **140** | **100** | **300** |

**4th SEMESTER**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sl. No.** | **Subject Type** | **Subject Code** | **Subject****Name** | **Teaching Hours** | **Credit** | **Maximum Marks** |
| **L** | **T** | **P** | **IA** | **EA** | **PA** | **Total** |
| 1 | Project 2 | PPRIT401 | Phase-II Dissertation | 0 | 0 | 32 | 16 | - | - | 100 | 100 |
| **Total** | **0** | **0** | **32** | **16** | **-** | **-** | **100** | **100** |

**Abstract of Credit and Marks Distribution**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl. No.** | **Semester** | **Maximum Credits** | **Maximum Marks** |
| 1 | 1st Semester | 18 | 800 |
| 2 | 2nd Semester | 18 | 800 |
| 3 | 3rd Semester | 16 | 300 |
| 4 | 4th Semester | 16 | 100 |
| **Total** | **68** | **2000** |

**NB:**

* **Any one of the Courses in Appendix-I is to be Decided by the Concerned Department for Audit-1 (1st Sem)**
* **Any one of the Courses in Appendix-II is to be Decided by the Concerned Department for Audit-2 (2nd Sem)**
* **Any one of the Courses in Appendix-III is to be Decided by the Concerned Department for Open Elective (3rd Sem)**

**Semester-1**

**Core 1: Data Mining (PPCIT101)**

**Prerequisites**

Data Structures and Algorithms, Database, SQL

**Course Outcomes**

1. Understand the fundamentals of data warehousing and data mining
2. Design data warehouses and define specific OLAP operations for analysis
3. Apply data mining techniques like classification, prediction, clustering
4. Gain knowledge about complex data types and spatial data mining.

**Module - I**

**Introduction to Data warehousing**: Definition and Characteristic, Need for data warehousing, Evolution of Decision support System, Building blocks of data warehouse, data warehouses and data marts, metadata in the data warehouse, Data warehousing Architecture, Data warehousing implementation, Business and data warehouse

**Data Warehouse Modelling and Design**: Multidimensional data model, Data cube, Schemas for multidimensional data models (Star, Snowflake, Fact Constellation), OLAP, OLAP Operations, OLAP Models (ROLAP, MOLAP, HOLAP), OLAP vs OLTP, Benefits of Data Warehousing

**Module - II**

**Introduction to Data Mining**: KDD Process, Data mining Functionalities, Classification of data mining systems, data mining task primitives, Integration of data mining system with data warehouse, Data Preprocessing (data summarization, data cleaning, data integration and transformation, data reduction, data discretization)

**Association Rule Mining**: Mining frequent patterns, associations, correlations (market basket analysis), Frequent Itemset Mining, (Apriori algorithm, FP-Growth), Correlation Analysis (Chi-square, Lift), Kinds of association rules

**Module - III**

**Classification**: Classification vs Prediction, issues, Decision tree induction, Attribute Selection Measures, Tree Pruning, Rule based classification, classification by Back Propagation, Bayseian Classification, Support Vector Machines

**Cluster Analysis**: Data in cluster analysis, Categorization of clustering methods, partitioning methods (k-means, k-medoids), hierarchical methods (AGNES, DIANA, BIRCH), density based methods (DBSCAN, OPTICS), Outlier Analysis

**Advanced Techniques:** Web Mining, Spatial Mining, Multimedia Datamining, temporal mining, Data mining applications (financial data Analysis, retail industry, telecommunication industry, Biological data analysis, intrusion detection), Social Impacts of Data Mining

**Text Books:**

1. Data Mining: Concepts and techniques: Han, Camber and Pei, Elsevier (3rd Edition).
2. Data Mining & Data Warehousing Using OLAP: Alex & Stephen, McGraw Hill

**Reference books:**

1. Data Mining Techniques and Applications by Hongbo Du, Cengage
2. Data Mining: Arun Pujari, University Press
3. Data Mining –a Tutorial based primer by R.J. Roiger, M.W. Geatz, Pearson Education.
4. Data Warehousing: Reema Thareja, Oxford University Press
5. Data warehousing Fundamentals: Paulraj Ponniah, Willey India.

**Core 2: Advanced Algorithm Design (PPCIT102)**

**Prerequisites**

Data Structure, Programming, Discrete Mathematics

**Course Outcomes**

1. Analyze the running time and space complexity of algorithms.
2. Develop and compare the comparison-based search algorithms and sorting algorithms.
3. Describe, apply and analyze the complexity of greedy strategy & dynamic programming strategy.
4. Understand backtracking, branch and bound and string matching techniques to deal with some hard problems

**Module I**

Algorithms, Performance analysis- time complexity and space complexity, Growth of Functions: - Asymptotic Notation, Recurrences: Substitution method, Recurrence tree method, The Master method, Heap structure: -Min-Max heap, Binomial heap, Fibonacci heap, skew heap, left shift heap, Divide and conquer–Quick sort, Searching- Binary search, Amortized analysis

Tree: - Binary Search Tree, AVL tree, B+ Tree, Red-Black Tree, 2-3 Tree, R-Trees, Dynamic Programming: -Floyd-Warshall algorithm, 0/1 Knapsack problem, Greedy algorithm: - Fractional Knapsack problem, Minimum Cost Spanning Trees, Kruskal's algorithm, Prim's algorithm, Single-source shortest paths Bellman-ford and Dijkstra's algorithms

**Module II**

 Backtracking: -N-Queen problem, Branch & Bound: - Branch & Bound algorithm for TSP, 15-puzzle, Maximum Flow: - Flow networks, The Ford-Fulkerson method, Geometric Algorithm: - Convex hulls, Segment Intersections, Closest Pair, Matrix Operations: - Properties of matrices, Strassen’s algorithm for matrix multiplication

**Module III**

String matching: Knuth-Morris-Pratt algorithm, naive string-matching algorithm, Internet Algorithm: -Tries, Ukonnen’s Algorithm, Polynomial Time, Polynomial-Time Verification, NP Completeness & reducibility, NP Completeness proofs, Cook’s theorem

**Text Book:**

1. Introduction to Algorithms by T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein, 3rd Edition (2009), PHI Learning Pvt. Ltd.
2. H. Bhasin: Algorithms, Design and Analysis, First Edition (2015), Oxford Higher Education.

**Reference Books:**

1. E. Horowitz, S. Sahani and Dinesh Mehta, Fundamentals of Data Structures in C++, First Edition (2009), Galgotia.
2. Mark Allen Weiss, “Data Structures & Algorithm Analysis in C/C++”, 3rd Edition (2009), Pearson Education India.
3. Adam Drozdex, Data Structures and algorithms in C++, Third Edition (2013), Thomson learning

**PE 1: Computational Intelligence (PPEIT101)**

**Prerequisites**

Neural Networks, Fuzzy Logic, Genetic Algorithms

**Course Outcomes**

1. Learn Computational Intelligence (CI) and their applications.
2. Analyze Various Neural Network Architectures.
3. Define Fuzzy System.
4. Analyze Genetic Algorithms and their applications.
5. Understand the concepts of Hybrid system.

**Module I**

**Neural Networks:** Introduction to CI, Fundamentals of Neural Network, Models of Artificial Neuron, Architecture, Learning Rules, Knowledge representation and Acquisition, Learning methods (Supervised, unsupervised, Competitive), Taxonomy of Neural Network systems: Single layer neural network, Multilayer neural network, Application of neural network in relevant fields.

**Neural Network Algorithms**: Back propagation, Feed Forward error back propagation, Associative memory, Auto associative memory, Hetero associative memory, Bidirectional associative memory, Kohonen Feature Map, Adaptive Resonance Theory, RBFN, k-means clustering.

**Module II**

**Fuzzy Logic:** Basic Concepts of Fuzzy Logic, Introduction to Fuzzy set theory, Fuzzy vs Crisp set, Fuzzy variables, Membership function, Operation, Properties, Fuzzy If-Then Rules, Variable Inference algorithm, Defuzzification, Fuzzy system design

**Module III**

**Genetic Algorithms**: Introduction, Basic of GA and genetic Engineering, Encoding, decoding, Operation of GA (Selection, Crossover, Mutation), Hybrid systems, Integration of Neural networks, fuzzy logic and genetic algorithm, Finite Element based optimisation, PSO, BFO, Hybridization of Optimization Techniques

**Text Book**

1. Neural networks, Fuzzy logic and Genetic Algorithm, Synthesis and Application by S. Rajasekaran, G.A. Vijayalakshami, PHI.
2. Introduction to Neural Networks by S. N. Sivanandam, S. Sumathi, S. N. Deepa (McGraw Hill)

**Reference Book**

1. Neural Networks and Learning Machines by Simon Haykin (Pearson)
2. Neuro Fuzzy and Soft Computing by Jang, Sun, Mizutani (PHI)
3. Neural Networks and Deep Learning by Charu C Agarwal (Springer)

**PE 1: Wireless Sensor Networks (PPEIT102)**

**Prerequisites**

Computer Networks, Operating system, Mobile Computing

**Course Outcomes**

1. Understand the basic WSN technology and supporting protocols, with emphasis placed on standardization basic sensor systems and provide a survey of sensor technology
2. Learn key routing protocols for sensor networks and main design issues
3. Learn transport layer protocols for sensor networks, and design requirements
4. Understand the Sensor management, sensor network middleware, operating systems

**Module I**

**Introduction:** Introduction to Wireless Sensor Networks, Node architecture, Operating System, Advantages of Sensor Networks, Application of Sensor Networks, Challenges and Constraints.

**Network deployment:** Structured vs randomized deployment, Network topology, Connectivity in geometric random graphs, Connectivity using power control, Coverage metrics, Mobile deployment.

**Localization:** Issues and approaches, Coarse-grained and Fine-grained node localization, Network-wide localization.

**Time Synchronization:** Reasons and challenges for time synchronization, Basics of time synchronization, Time synchronization protocols – Receiver Broadcast Synchronization, Timing-Sync Protocol for Sensor Networks and Flooding Time Synchronization Protocol.

**Module Il**

**Physical Layer:** Basic components, Source and Channel Encoding, Modulation, Signal Propagation.

**MAC Layer:** Wireless MAC Protocols (CSMA, MACA, MACAW), Characteristics of MAC protocols in Sensor Networks, Contention-Free MAC protocols (TRAMA, YMAC, LEACH), Contention-Based MAC protocols (PAMAS, SMAC, TMAC), Hybrid MAC protocols.

**Network Layer:** Classification of Routing Protocol, Routing metrics, Flooding and gossiping, Data-Centric routing (SPIN, Directed Diffusion, Gradient), Proactive routing (DSDV, OLSR), On-Demand routing (AODV, DSR), Hierarchical routing, Location-Based routing (UNICAST, MULTICAST, GAF), QoS-Based routing protocols

**Module III**

**Reliability and congestion control:** Basic mechanisms, Reliability guarantees, Congestion control, Real-time scheduling.

**Security:** Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks.

**Text Books:**

1. Fundamentals of Wireless Sensor Network: Theory and Practice: Waltenegus Dargie and Christian Poellabauer, Wiley Publication, 2010.
2. Networking Wireless Sensors: Bhaskar Krismachari, Cambridge University Press

**References Books:**

1. Wireless Sensor Networks: An Information Processing Approach- by Feng Zhao, Leonidas Guibas, Morgan Kaufmann Series in Networking 2004
2. Wireless Sensor Networks: Edited by C.S Raghavendra, Krishna M, Sivalingam, Taieb Znati, Springer

**PE 1: Internet of Things (PPECS101)**

**Prerequisites**

Computer Networks Fundamentals, Socket programming, Python (Optional)

**Course Outcomes**

1. Know how about implementation of devices connected over Internet
2. Design tools for IoT
3. Analyze data collected from IoT devices

**Module-1:**

What is the Internet of Things?: History of IoT, About IoT, Overview and Motivations, Examples of Applications, Internet of Things Definitions and Frameworks: IoT Definitions, IoT Architecture, General Observations, Working Definition, IoT Frameworks

 Physical Design of IoT- Things in IoT, IoT Protocols, Logical Design of IoT- IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies- Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels & Deployment Templates Introduction, M2M-Difference between IoT and M2M.

**Module-2:**

RADIO FREQUENCY IDENTIFICATION TECHNOLOGY

 RFID: Introduction, Principle of RFID, Components of an RFID system, Issues EPC Global Architecture Framework: EPCIS & ONS, Design issues, Technological challenges, Security challenges, IP for IoT, Web of Things.

Wireless Sensor Networks: History and context, WSN Architecture, the node, Connecting nodes, Networking Nodes, Securing Communication WSN specific IoT applications, challenges: Security, QoS, Configuration, Various integration approaches, Data link layer protocols, routing protocols and infrastructure establishment.

RESOURCE MANAGEMENT IN THE INTERNET OF THINGS

Clustering, Software Agents, Clustering Principles in an Internet of Things Architecture, Design Guidelines, and Software Agents for Object Representation, Data Synchronization.

**Module-3:**

INTERNET OF THINGS PRIVACY, SECURITY AND GOVERNANCE

Vulnerabilities of IoT, Security requirements, Threat analysis, Use cases and misuse cases, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity, Non-repudiation and availability, Security model for IoT.

BUSINESS MODELS FOR THE INTERNET OF THINGS

Business Models and Business Model Innovation, Value Creation in the Internet of Things, Business Model Scenarios for the Internet of Things. Internet of Things Application: Smart Metering Advanced Metering Infrastructure, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards Use of Big Data and Visualization in IoT, Industry 4.0 Concepts. Low-power design (Bluetooth Low Energy),

**Text Books**

1. Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118-47347-4, Willy Publications
2. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
3. Parikshit N. Mahalle & Poonam N. Railkar, “Identity Management for Internet of Things”, River
4. Publishers, ISBN: 978-87-93102-90-3 (Hard Copy), 978-87-93102-91-0 (eBook).

**Reference Books**

1. Hakima Chaouchi, “The Internet of Things Connecting Objects to the Web” ISBN: 978-1-84821-140-7, Willy Publications
2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2nd Edition, Willy Publications
3. Daniel Kellmereit, Daniel Obodovski, “The Silent Intelligence: The Internet of Things”, Publisher: Lightning Source Inc; 1 edition (15 April 2014). ISBN-10: 0989973700, ISBN-13: 978-0989973700.
4. Fang Zhaho, Leonidas Guibas, “Wireless Sensor Network: An information processing approach”, Elsevier, ISBN: 978-81-8147-642-5.

**PE 1: Advanced Database Systems (PPEIT103)**

**Prerequisites**

Data Base Management System, Computer Networks

**Course Outcomes**

* + 1. Explain and evaluate the fundamental theories and requirements that influence the design of distributed database systems
		2. Learn alternative designs and architectures for databases
		3. Discuss and evaluate different query optimization techniques.
		4. Analyze the background processes involved in transactions and explain how these impact on database operation and design

**Module-I:**

Introduction to Distributed Database: Distributed Data Processing, Concept of Distributed Database, distributed vs Centralized Database System; advantages and Application

Levels of Distribution Transparency- Reference architecture for distributed databases, types of data fragmentation- Horizontal, Vertical and Mixed, Distribution Transparency for Read-Only operations, Integrity Constraints in Distributed Database

Distributed Database Design: A framework for Distributed Database Design, The Design of Database Fragmentation, The Allocation of Fragments

**Module -II:**

Distributed Query Processing: Overview of Query Processing, Query Processing Problem, Objectives of Query Processing, Complexity of Relational Algebra Operations, Characterization of Query Processors, Layers of Query Processing, Query Decomposition and Data Localization, Optimization of Distributed Queries, Query Optimization-Centralized Query Optimization, Join Ordering in Distributed Queries, Distributed Query Optimization

**Module -III:**

Transaction Management- Definition and its types

Concurrency Control mechanism -Distributed Concurrency Control, Taxonomy of Concurrency Control Mechanisms, Locking-Based Concurrency Control Algorithms - Distributed Two phase Locking Protocol

Timestamp-Based Concurrency Control Algorithms- Basic TO Algorithm, Conservative TO Algorithm, Multiversion TO Algorithm

Deadlock Management - Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Resolution

“Relaxed” Concurrency Control - Non-Serializable Histories Nested Distributed Transactions

Distributed DBMS Reliability- Reliability Concepts and Measures, Failures in Distributed DBMS, Distributed Reliability Protocols Components of Distributed Reliability Protocols Two-Phase Commit Protocol

**Text Book**

1. S. Ceri, G. Pelagatti, Distributed databases: Principles and Systems, McGraw Hill
2. Ozsu, M. Tamer and Patrick Valduriez, Principles of Distributed Database Systems, 3rd edition, Springer

**Reference Book**

1. Silberschatz, Abraham, Henry F. Korth and S. Sudarshan: Database System Concepts, 6th Edition (2010), McGraw Hill International Edition
2. Ramez Elmasri, Shamkant B. Navathe: Fundamentals of Database Systems, 7th Edition (2016), Pearson.

**PE 2: Information Theory and Coding Techniques (PPEIT104)**

**Prerequisites**

Mathematical Fundamentals, Computer Networks

**Course Outcomes**

1. Understand various principles governing real world data communication
2. Guarantee of accurate data compression and data delivery

**Module-I:**

Introduction to information Theory, Information and entropy, properties of entropy of a binary memory less source, Measure of Information; Chain rule for entropy, relative entropy and mutual entropy; Source Coding, Shannon-Fano coding, Huffman coding, Lempel ZIV coding, Information Capacity Theorem, The Shannon Limit, channel coding, Channel capacity, noisy channel coding theorem for DMC.

**Module-II:**

Linear block codes, generator matrices, parity check matrices, encoder syndrome and error detection-minimum distance, error correction and error detection capabilities, cyclic codes, coding and decoding.

**Module-III:**

Coding convolutional codes, encoder, generator matrix, transform domain representation state diagram, distance properties, maximum likelihood decoding, Viterbi decoding, sequential decoding, interleaved convolutional codes.

**Text Books:**

1. Information Theory, Coding and Cryptography, Ranjan Bose, TMH

2. R. Mc Eliece, The Theory of Information and Coding, Addison-Wesley.

**Reference Books:**

1. Elements of Information Theory, T.M. Cover, J.A. Thomas, Wiley
2. Information Theory and Coding, Hari Bhat & Ganesh Rao, CENGAGE

**PE 2: Internet Programming (PPEIT105)**

**Prerequisites**

HTML, JavaScript, XML, DOM

**Course Outcomes**

* 1. Design real world solutions for web
	2. Utilize web resources for various research and societal applications

**Module-I**

Web 2.0: Basics-RIA Rich Internet Applications, Collaborations tools, understanding websites and web servers: Understanding Internet, Difference between websites and web server- Internet technologies Overview, Understanding the difference between internet and intranet; HTML and CSS: HTML 5.0, XHTML,

**Module-II**

Java Script: An introduction to JavaScript, JavaScript DOM Model-Date and Objects, -Regular Expressions- Exception Handling-Validation-Built-in Objects-Event Handling- DHTML with JavaScript. Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server; - Database Connectivity: JDBC perspectives, JDBC program example, JSP: Understanding Java Server Pages-JSP Standard Tag Library(JSTL)-Creating HTML forms by embedding JSP code.

**Module-III**

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in Functions-Connecting to Database, Using Cookies-Regular Expressions; XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; Web Services: Introduction- Java web services Basics, Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application, SOAP.

**Text Books:**

1. Web Technologies A Computer Science Perspective by Jeffrey C and Jackson, Pearson Education, 2011
2. Web Technology by N.P. Gopalan and J. Akilandeswari, 2nd Edition, Prentice Hall of India, 2014

**Reference Books:**

1. The Complete Reference JavaScript by Thomas A. Powell, Fritz Schneider, Mc Graw Hill, 2001
2. The Complete Reference AJAX by Thomas A. Powell, McGraw Hill, 2008
3. Head First JavaScript by Michael Morrison, O Reilly, 2007
4. Head First AJAX by Rebecca Riordan, O Reilly, 2008

**PE 2: Information Security and Cyber Laws (PPEIT106)**

**Prerequisites**

Cryptography, Computer Security

**Course Outcome**

1. Gather knowledge about laws governing computer and network security
2. Utilize knowledge of cyber law in designing real life applications
3. Understand intellectual properties
4. Learn digital forensics

**Module-I:**

Information Security Fundamentals: OSI Security architecture, Need of information and data security, Cryptography, Steganography, PKI (Public Key Infrastructure), Digital Signature, electronic signature, IP Security, Web security, SSL, TLS

Threats to information security: Intrusion, Viruses, worms, malwares, worms, Trojan horses, DoS Attack, DDoS Attack

Countermeasures of Information Security: Common criteria for information security evaluation, Firewalls, Intrusion detection Systems

**Module-II:**

Cyber Law: Necessity and evolution of IT Act

Salient features of IT Act 2000: Various authorities under IT Act 2000, Powers, penalties, offences and amendments, Impact of IT act amendment on Indian Penal Code, Indian Evidence Act

E-Commerce Laws: Issues and provisions in Indian laws, E-taxation issues in cyberspace, E-contracts and its legal validity in India, Cyber tribunal and appellate tribunal

**Module-III:**

Intellectual property rights, domain names, trademark disputes: Concept of trademark in Internet era, Jurisdiction in trademark dispute, copyright in digital media and computer programs, WIPO Treaty, EU Convention on Cybercrime, concept of patent right

Cybercrime and digital forensics: Reason for cybercrimes, cyber-criminal mode and manner of committing cybercrime, Computer forensics, mobile forensics, forensic tools

**Text Books:**

1. Cryptography and Network Security, William Stallings, 4th Edition, Pearson
2. Computer Forensics: Principals and Practices by Linda Volonino, Reynaldo Anzaldua and Jana Godwin; Pearson Prentice –Hall

**Reference Books:**

1. Computer Forensics and Investigations, Bill Nelson, Cengage Learning
2. Cyber Law & Cyber Crimes by Advocat Prashant Mali; Snow White publications, Mumbai
3. Cyber Law in India by Farooq Ahmad; Pioneer Books
4. The Information Technology Act, 2000; Bare Act –Professional Book Publishers, New Delhi

**PE 2: Cloud Computing (PPECS105)**

**Prerequisites**

Computer Networking, Distributed Computing, Web Technology, Service-Oriented Architecture, Virtualization

**Course Outcomes**

1. Analyze the Cloud computing setup with its vulnerabilities and applications using different architectures.
2. Apply and design suitable Virtualization concept, Cloud Resource Management and design scheduling algorithms.
3. Create combinatorial auctions for cloud resources and design scheduling algorithms for computing clouds
4. Assess cloud Storage systems and Cloud security, the risks involved, its impact and develop cloud application.

**Module-1**

**Introduction:** Cloud-definition, benefits, usage scenarios, History of Cloud Computing – Cloud Architecture – Types of Clouds – Business models around Clouds – Major Players in Cloud Computing – issues in Clouds, Risks Involved in Cloud Computing.

**Cloud Services:** Types of Cloud services: Software as a service – Platform as a Service – Infrastructure as a Service – database as a Service – Monitoring as a Service – Communication as services, Service providers – Google, Amazon, Microsoft Azure, IBM, Salesforce.

**Module-2:**

**Collaborating Using Cloud Services:** Email Communication over the Cloud – CRM Management – Project Management – Event Management – Task Management **Virtualization For Cloud:** Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization – System Vm, Process VM, Virtual Machine monitor – Virtual machine properties – Interpretation and binary translation, HLL VM – Hypervisors – Xen, KVM, VMWare, Virtual Box, Hyper-V.

**Module-3**

**Data & Cloud Storage:** Enterprise Data Storage (SAN, NAS), Cloud File System, Cloud Data stores & Data management for cloud storage.

**Security, Standards and Applications:** Security in Cloud: Cloud security challenges – Software as a Service Security, Common Standards: The Open Cloud Consortium – The Distributed Management Task Force – Standards for application Developer – Standards for Messaging – Standards for Security, End user access to cloud computing, Mobile Internet devices and the cloud

**Other Ways to Collaborate Online:** Collaborating via Web - Based Communication Tools - Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis. Cloud Computing Platforms & tools: Eucalyptus – Nimbus – Open Nebula, CloudSim, Apache, Hadoop, Map Reduce

**Text Books:**

1. John Rittinghouse and James Ransome, “Cloud Computing, Implementation, Management and Strategy”, CRC Press, 2009.
2. Cloud Computing Principles & Paradigms by Buyya,Brobery & Goscinni(Wiley).
3. Cloud Computing by Srinivasan & Suresh(Pearson).

**References:**

1. Cloud Computing by Bagha & Madisetti, University Press
2. Anthony T Velte, Toby J Velte and Robert Elsenpeter, “Cloud Computing: A Practical Approach”, Tata McGraw-Hill, 2009.
3. David E. Y. Sarna, “Implementing and Developing Cloud Application”, CRC press 2011.

**MC: Research Methodology & IPR (PMCMH101)**

**Module I:**

Introduction to RM: Meaning and significance of research. Importance of scientific research in decision making. Types of research and research process. Identification of research problem and formulation of hypothesis. Research Designs.

Types of Data: Primary data Secondary data, Design of questionnaire; Sampling fundamentals ad sample designs, Methods of data collection, Measurements and Scaling Techniques, Validity & Reliability Test.

**Module II:**

Data Processing and Data Analysis-I, Data editing, Coding, Classification and Tabulation, Descriptive and Inferential Analysis, Hypothesis Testing- Parametric Test (z test, t test, F test) and non-parametric test (Chi square Test, sign test, Run test, Krushall-wallis test).

**Module III:**

Data Analysis II: Multivariate Analysis- Factor Analysis, Multiple Regression Analysis. Discriminant Analysis, Use of Statistical Packages.

**Reference Books:**

1. Research Methodology, Chawla and Sondhi, Vikas

2. Research Methodology, Paneerselvam, PHI

**Course Outcomes:**

**CO1:** Understood the Meaning of research problem, Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

**CO2:** Got the knowledge of How to get new ideas (Criticizing a paper) through the Literature Survey (i.e. Gap Analysis).

**CO3:** Understood the Filing patent applications- processes, Patent Search, Various tools of IPR, Copyright, Trademarks.

**CO4:** Understood How to apply for Research grants and Significance of Report Writing, Steps in Report Writing, Mechanics and Precautions of Report Writing, Layout of Research Report.

**CO5:** Got the knowledge of How to write scientific paper & Research Proposal - Structure of a conference and journal paper, how (and How Not) to write a Good Systems Paper:

**Lab 1: Advanced Data Structure and Algorithm Lab (PLCIT101)**

**Prerequisites**

Programming Languages, Sorting Algorithms, Graph theory, Tree

**Course Outcomes**

* 1. Implement a variety of algorithms such as sorting, graph related, combinatorial, etc., in a high-level language.
	2. Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.)
	3. Apply and implement learned algorithm design techniques and data structures to solve real world problems

**Experiment 1** I. Implement a heap sort using a max heap

II. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements

**Experiment 2** I. Use divides and conquers method to recursively implement Binary Search

II. Use divides and conquers method to recursively implement Linear Search

**Experiment 3** Write a program to perform the following operations on AVL Tree: i) Creation ii) Insertion iii) Deletion

**Experiment 4** Implement 0/1 Knapsack problem using Dynamic Programming

**Experiment 5** From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.

**Experiment 6** Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's Algorithm.

**Experiment 7** Find Minimum Cost Spanning Tree of a given undirected graph using Prim’s algorithm.

**Experiment 8** Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.

**Experiment 9** Implement N Queen's problem using Back Tracking

**Experiment 10**Write a program for Naive string-matching algorithm

**Lab 2: Computing Lab-I (PLCIT102)**

**Prerequisites**

Knowledge of networking and programming fundamentals.

**Course Outcomes**

* 1. Students will gain knowledge about networking experiments and simulation.
	2. Exposure to hands on coding.

**Experiment 1** Analyzing Number of Transmitting Nodes Vs Collision count, Mean Delay for an Ethernet LAN.

**Experiment 2** Analyzing Bus Vs Star topology with respect to number of collisions (for a fixed number of transmitting nodes) for Ethernet LAN.

**Experiment 3** Analyzing the difference between Hub vs Switch transmission with respect to throughput and delay.

**Experiment 4** Analyzing the performance of Token Ring with Number of Nodes vs Response Time, Mean Delay using NETSIM.

**Experiment 5** Comparing CSMA/CA vs CSMA/CD protocol with respect to throughput and collision count (for a fixed number of transmitting nodes).

**Experiment 6** a) Verification of Stop and Wait Protocol.

b) Verification of Go Back N Protocol.

c) Verification of Selective Repeat Protocol.

**Experiment 7** Matlab basics and elementary calculations.

**Experiment 8** Implementation of various matrix operations using Matlab:

 a) Matrix addition

b) Matrix subtraction

 c) Matrix multiplication

 d) Transpose of a matrix

 e) Inverse of a matrix.

**Experiment 9** Built in Function for matrix operation using Matlab.

**Experiment 10** Plotting graphs in 2D and 3D IN line graph, bar graph and pie chart using Matlab.

**Audit -1**

**[To be decided by the Department]: Refer Appendix-I**

**Semester-2**

**Core 3: Software Engineering (PPCIT201)**

**Prerequisites**

Computer Programming, Program Design, Computer Systems Analysis.

**Course Outcomes**

* 1. Define various software application domains and remember different process model used in software development.
	2. Explain needs for software specifications also they can classify different types of software requirements and their gathering techniques.
	3. Convert the requirements model into the design model and demonstrate use of software and user-interface design principles.
	4. Generate project schedule and can construct, design and develop network diagram for different type of Projects. They can also organize different activities of project as per Risk impact factor.

**MODULE-I:**

Evolution of Software Design Technique: Adhoc Base, Control Base, Data Structure, Data Flow, Objective Oriented, Product and Process. Process Model: SDLC, Waterfall model, Incremental Process Model, Evolutionary Process Model, Prototype, Spiral, Agile Model, Unified Process. Component Base Software Developer Model: Y model, V model, X model, W model, Fountain Model. 4P Approach (People, Process, Project, Product)

**MODULE-II:**

Software Cost Estimation: Basics of cost estimation, Software Cost Estimation Process, Decomposition Techniques, Software Estimation Model, Software Metrics: Guidelines for software Metrics, Designing Software Metrics, Classification of Software Metrics, COCOMO, COCOMO-II, Metrics for Design Model: Architectural Design Metrics, Metrics for OO Design, Class Oriented Metric, Component-Level Design Metric, Metrics for Testing, Metrics in the Process and Project Domains.

Software Measurement: Size-Oriented Metrics, Function-Oriented Metrics, Object-Oriented Metrics, Use-Case Oriented Metrics, Web Engineering Project Metrics. Booch Notation, Rumbaugh Object Modeling Technique, Jacabson Model, Overview of Object-Oriented Concept, UML Diagram: Use Case Diagram, Class Diagram, Object Diagram, Sequence Diagram, Collaboration Diagram, Activity Diagram, State Chart Diagram, Component Diagram, Deployment Diagram

**MODULE-III:**

Testing: Stress testing, volume testing, compatibility testing, recovery testing, and regression testing, user Interface testing, Configuration Testing, Security testing, Software Quality Assurance, Software Reliability, Change Management: SCM, SCM repository, SCM Process, Cleanroom Software Engineering, Re-engineering: Software reengineering, Restructuring, Forward Engineering

**Text Books:**

1. Software Engineering, A Practitioner’s Approach, Roger S. Pressman, 6th edition, TMH
2. Fundamentals of Software Engineering, Rajib Mall, 5th edition, PHI

**Reference Books:**

1. Ali Behforooz, Frederick J. Hudson, Software Engineering Fundamentals, 8th Edition, Oxford University Press
2. Software Engineering, I. Sommerville, 9th Edition, Pearson Education
3. Software Engineering, Jibitesh Mishra & Ashok Mohanty, Pearson Education, 2012

**Core 4: Mobile Computing (PPCIT202)**

**Prerequisites**

Computer Network, Data Communication, Operating System

**Course Outcomes**

1. Explain the basic concepts of wireless network and wireless generations.
2. Demonstrate the different wireless technologies such as CDMA, GSM, GPRS etc
3. Describe and judge the emerging wireless technologies standards such as WLL, WLAN, WPAN, WMAN.
4. Explain the design considerations for deploying the wireless network infrastructure.

**Module – I:**

Introduction: Three Tier Architecture Mobile Computing Architecture, Evolution of Wireless Technology

Wireless Transmission: Signal, Antenna, Signal Propagation, Multiplexing, Modulation, Spread Spectrum

Cellular System: Cell, Cluster, Cell Splitting, Frequency Reuse, Frequency Management, Channel Assignment Strategies, Components of Cellular System, Operation of Cellular System

**Module – II:**

Global System for Mobile Communication (GSM): Overview, Architecture, Addresses and identifiers, Network signaling, Radio interfaces, Channels, Mobility Management.

General Packet Radio Services (GPRS): Architecture, GPRS Interfaces, Network Protocols, GPRS Handsets

Wireless LAN (WLAN): Application, Requirement, IEEE 802.11(Ad-hoc Mode, Infrastructure Mode, Protocol Architecture), Bluetooth (Piconet, Scatternet, Protocol Stack, Bluetooth Profile)

Mobile Ad-Hoc Network: Types, Topology, Applications, Proactive Routing (DSDV, OLSR), Reactive Routing (AODV, DSR), Hybrid Routing (ZRP)

**Module – III:**

Wireless Application Protocol (WAP): WAP Gateway and Protocols, Wireless Markup Languages (WML)

Mobile IP: Terminology, Operations, Location Management, Mobility Management

IMT 2000: Vision, IMT-2000 Family, UMTS (Architecture, Interfaces)

Emerging Technologies: WiFi, WiMax, LTE

**Text Books:**

1. Mobile Communication: J. Schiller, 2ND Edition, Pearson Education
2. Mobile Computing: Asoke Talukdar, 2nd Edition, TMH.

**Reference Books:**

1. Mobile Computing: P.K. Patra, S.K. Dash, 2nd Edition, Scitech Publications.
2. Fundamentals of Mobile Computing, Prashanta Kumar Patnaik and Rajib Mall, PHI, 2nd Edition, 2015
3. Mobile Computing, Raj Kamal, 2nd Edition, Oxford University Press
4. Wireless Communications, T.L. Singhal, TMH

**PE 3: Network and System Security (PPEIT201)**

**Prerequisites**

Discrete logarithms, Elliptic curves, Computer networking, Finite field, Number Theory, Security protocol

**Course Outcomes**

* 1. Understand theory of fundamental cryptography, encryption and decryption algorithms.
	2. Understand the Public-Key Infrastructure ·
	3. Understand security protocols for protecting data on networks.
	4. Evaluate the authentication and hash algorithms.

**Module I:**

Introduction to Information Security: The meaning of computer security, computer criminals, methods of defense, Security Goals, Attacks, Security services and Mechanism. Cryptography: Plain Text and Cipher Text, Encryption and Decryption, Substitution cipher, Transposition Cipher, Stream and Block Cipher, Modern block ciphers, Modern stream Ciphers, Data Encryption Standard (DES), Advanced Encryption Standard (AES),

**Module II:**

Public key cryptography: Principles of public key cryptosystems-The RSA Algorithm-Key management – Diffie Hellman Key exchange. Hash Functions, Digital Signatures. Network security: Electronic mail security: E-mail, PGP, S/MIME. IPsec: IP security overview, architecture, Internet key exchange, ISAKMP, Encapsulating security payload.

**Module III:**

Web security: secure socket layer (SSL), Transport layer security. System Security: Description of the system, worms, viruses, IDS. Firewalls: Definitions, construction & working principles. Entity authentication: Passwords, challenge-response algorithms, zero-knowledge protocols. Legal & ethical issues in computer security: protecting programs & data, Information & law, rights of employees & employers.

**Text Book**

1. Security in computing, Charles P, Pfleeger, Shari Lawrence Pfleeger, 4th edition, PHI
2. Behrouz A. Ferouzan, “Cryptography & Network Security”, Tata Mc Graw Hill, 2007.

**Reference book**

1. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education,
2. Neal Koblitz, A course in number theory and cryptography, Springer.
3. Johannes A. Buchmann, Introduction to Cryptography, Undergraduate Text in Mathematics, Springer.
4. Doug Stinson, Cryptography Theory and Practice, CRC Press.

**PE 3: Advanced Computer Architecture (PPEIT202)**

**Prerequisites**

Programming and Data Structures, Discrete Mathematics, Computer Organization

**Course Outcomes**

1. Design basic and intermediate RISC pipelines, including the instruction set, data paths, and ways of dealing with pipeline hazards.
2. Consider various techniques of instruction-level parallelism, including super scalar execution, branch prediction, and speculation, in design of high-performance processors.
3. State and understand memory hierarchy design, memory access time formula, performance improvement techniques, and trade-offs.
4. Learn from additional topics in computer architecture, such as multi-core processors, thread-level parallelism, and warehouse computing.

**Module – I:**

Principles of Processor Performance, Amdahl’ Law, Basic Multiprocessor Architecture: Flynn’s Classification, Share Memory Architecture (UMA, NUMA, NORMA, COMA), Distributed Memory Architecture, Array Processor, Vector Processors, Associative Processor, Systolic architecture, RISC and CISC Architectures.

**Module – II:**

Pipelining Fundamentals, Linear Pipelining (Arithmetic and Instruction Pipeline), Pipeline Hazards, Superscalar Architecture, Super Pipelined Architecture, Instruction Level Parallelism (ILP): ILP Hazards, VLIW Architecture. Interconnection Networks: Crossbar Switches, Suffle Transformation, Omega Network (Butterfly Network), Static Networks, Dynamic Networks, Network Topologies.

**Module –III:**

Hierarchical Memory Technology: Data and Instruction Caches, Multi-level Caches, Cache memory mapping policies, Cache Coherence Problem (Hit Time, Miss Rate), Snoopy Bus protocol, Direct Bus Protocol, Hardware Synchronization Mechanism, Memory Inter leaving, Memory Management Hardware.

Data Flow Computer Architecture: Static Data Flow computer, Dynamic Data Flow computer, Cluster computers, Distributed computing, Case Studies: ARMs and SPARC Processor.

**Text Books:**

1. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, 6th Edition, Morgan Kaufmann
2. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, 3rd Edition, McGraw Hill.

**Reference Books:**

1. David A. Patterson and John L. Hennessy, Computer Organization and Design, 5th edition, 2013, Morgan Kaufmann.
2. V. Carl Hamacher, Zvonko G. Vranesic, Safwat G. Zaky Snippet, Computer Organization, 5th edition, 2002, McGraw Hill.
3. K. Hwang and F. A. Briggs, Computer Architecture and Parallel Processing, McGraw Hill.

**PE 3: Fault Tolerant System (PPEIT203)**

**Prerequisites**

Digital electronics, Computer Architecture, operating systems, Computer networks

**Course outcome**

The students will be able to learn and design fault tolerant systems which are need of the future

**Module-I**

**BASIC TERMS:**

Definition of fault tolerance, Redundancy, Applications of fault-tolerance, Fundamentals of dependability.

Attributes: Reliability, availability, safety, Impairments: faults, errors and failures, Means: fault prevention, removal and forecasting

**DEPENDABILITY EVALUATION:**

Common measures: failures rate, mean time to failure, mean time to repair, etc. Reliability block diagrams, Markov processes

**Module-II**

**REDUNDANCY:**

Hardware redundancy, Redundancy schemes, Evaluation and comparison, Applications, Information redundancy, Codes: linear, Hamming, cyclic, unordered, arithmetic, etc., Encoding and decoding techniques, Applications, Time redundancy

**Module-III**

**PROGRAMMING:**

Software fault tolerance, Specific features, Software fault tolerance techniques: N-version programming, recovery blocks, self-checking software, etc.

**Text Books**

* 1. Anderson, T., and P.A. Lee, Fault-Tolerant Principles and Practices, Prentice-Hall
	2. Hwang, K., and F.A. Briggs, Computer Architecture and Parallel Processing, McGraw-Hill.
	3. Jalote, P. Fault-Tolerance in Distributed Systems, ISBN 0-13-301367-7, Prentice-Hall,

**Reference Books**

* 1. Johnson, B.W., Design and Analysis of Fault-Tolerant Systems, Addison Wesely
	2. Leveson, Nancy G., Safeware, system safety and computers, Addison Wesely.
	3. Pradhan, D.K., Fault-Tolerant Computing — Theory and Techniques, (2 Volumes), Prentice-Hall.
	4. Pradhan, Dhiraj K., Fault-Tolerant Computer System Design, ISBN 0-13-057887-8, Prentice-Hall

**PE 3: Soft Computing (PPECS208)**

**Prerequisites**

Linear Algebra, Multivariate Calculus, Probability theory, Programming Language

**Course Outcomes**

1. Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.
2. Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic
3. Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications
4. Solving optimization problem using Genetic Algorithm and Evolutionary Algorithm

**Module-1:**

Introduction to Soft Computing: Concept of computing systems, "Soft" computing versus "Hard" computing, Characteristics of Soft computing, Some applications of Soft computing techniques Artificial Neural Networks, Biological neurons and its working, Simulation of biolgical neurons to problem solving, Different ANNs architectures, Training techniques for ANNs, Applications of ANNs to solve some real life problems.

**Module-2:**

Fuzzy logic: Introduction to Fuzzy logic, Fuzzy sets and membership functions, Operations on Fuzzy sets, Fuzzy relations, rules, propositions, implications and inferences, Defuzzification techniques, Fuzzy logic controller design, Some applications of Fuzzy logic.

**Module-3:**

Genetic Algorithms: Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques, Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, etc., Solving single-objective optimization problems using Gas, Multi-objective Optimization Problem Solving, Concept of multi-objective optimization problems (MOOPs) and issues of solving them, Multi-Objective Evolutionary Algorithm (MOEA), Non-Pareto approaches to solve MOOPs, Pareto-based approaches to solve MOOPs, Some applications with MOEAs.

**Reference Books:**

1. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S. Rajasekaran, G. A. Vijayalakshami, PHI.

2. Chin Teng Lin, C. S. George Lee, Neuro-Fuzzy Systems, PHI

3. Fuzzy Logic with Engineering Applications Timothy J. Ross (Wiley)

4. E. Goldberg, Genetic Algorithms: Search and Optimization, Addision-Wesley

5. Principles of Soft Computing, S.N. Sivanandam, S.N. Deepa, Wiley, 2nd edition

6. Evolutionary Algorithm for Solving Multi-objective, Optimization Problems (2nd Edition), Collelo, Lament, Veldhnizer (Springer)

7. An Introduction to Genetic Algorithm Melanic Mitchell (MIT Press)

8. Neural Networks and Learning Machines Simon Haykin (PHI)

9. [AN INTRODUCTION TO NEURAL NETWORKS](https://www.phindia.com/Books/BookDetail/OTc4ODEyMDMxMzUxNA), [ANDERSON, JAMES A.](https://www.phindia.com/Books/Author/OTc4ODEyMDMxMzUxNA), PHI

**PE 4: Service Oriented Architecture (PPEIT204)**

**Prerequisites**

Software Engineering, Web Technologies

**Course Outcomes**

* + - Understand the applicability of SOA design patterns and the meaning of the major SOA implementation technologies
		- Compare SOA with other architectural paradigms
		- Analyze requirements towards the creation of a service
		- Classify and make reasoned decision about the adoption of different SOA platforms

**Module I:**

Object-oriented analysis and design, Object-Oriented Modelling, Object-Oriented Design Principles, Software Design Patterns

Software Architecture: UML architecture diagrams, Architectural Styles, Distributed System, Middleware, Enterprise Application Integration

**Module II:**

SoA Basics: Characteristics of SOA, Benefits of SOA, Comparing SOA with Client-Server and Distributed architectures –– Principles of Service Orientation – Service layers

SOA delivery strategies – Service oriented analysis – Service Modelling – Service oriented design – Standards and composition guidelines — Service design – Business process design

REST Architecture for SOA, Sample Implementation of REST Service, Sample Implementation of REST Service Composition.

**Module III:**

Web Services Platform – Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Service-Level Interaction Patterns – Orchestration and Choreography

WS-Addressing – WS-Reliable Messaging – WS-Policy – WS-Coordination – WS -Transactions – WS-Security – Examples

**Text Books:**

* 1. Thomas Erl, ― Service Oriented Architecture: Concepts, Technology, and Design, Pearson Education, 2005
	2. Sandeep Chatterjee and James Webber, ―Developing Enterprise Web Services: An Architect’s Guide, Prentice Hall, 2004

**Reference Books:**

1. James McGovern, Sameer Tyagi, Michael E Stevens, Sunil Mathew, ―Java Web Services Architecture, Elsevier, 2003.
2. Ron Schmelzer et al. ― XML and Web Services, Pearson Education, 2002.
3. Frank P. Coyle, ―XML, Web Services and the Data Revolution, Pearson Education, 2002

**PE 4: Big Data Analysis (PPEIT205)**

**Prerequisites**

Programming Languages, Data Structure and Algorithms

**Course Outcomes**

* + - Identify Big Data and its Business Implications.
		- Understand components of Hadoop and Hadoop Eco-System
		- Access and Process Data on Distributed File System
		- Develop Big Data Solutions using Hadoop Eco System

**Module 1:**

Introduction to Big Data Analytics: Big Data Overview, Characteristics, Traditional versus Big Data Approaches, State of the Practice in Analytics, Key Roles for the New Big Data Ecosystem and its Challenges, Example of Big Data Analytics, Data Analytics Lifecycle: Overview, Discovery, Data Preparation, Model Planning, Model Building, Communicate Results

**Module 2:**

Advanced Analytical Theory and Methods: Overview of Clustering Techniques, K-Means, Hierarchical Clustering, Partitioning Methods, Clustering Streams, Overview of Association Rules, Apriori Algorithm, Applications of Association Rules, Transactions in Grocery Store Example, Classification: Decision Trees - Overview of a Decision Tree -The General Algorithm - Decision Tree Algorithms - Evaluating a Decision Tree - Decision Trees in R - Naïve Bayes – Bayes’ Theorem - Naïve Bayes Classifier.

**Module 3:**

Advanced Analytics – Technology and Tools: Introduction to Hadoop, Core Hadoop Components, Hadoop Ecosystem, Physical Architecture, Limitations of Hadoop, Introduction to NoSQL, NoSQL Business Drivers, NoSQL Case Studies (Amazon Dynamo DB, Googles’ Big Table, Mango DB), NoSQL Data Architectural Patterns, Using NoSQL to Manage Big Data, Introduction to Map Reduce, Algorithms using Map Reduce.

**Text Books:**

* 1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
	2. Radha Shankarmani and M Vijayalakshmi, Big Data Analytics, 2nd Edition, Wiley India Pvt. Ltd., 2017.

**Reference Books:**

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
2. Dan McCreary and Ann Kelly “Making Sense of NoSQL” – A guide for managers and the rest of us, Manning Press.

**PE 4: Information Retrieval (PPEIT206)**

**Prerequisites**

File and storage systems, Data Structures, Data Mining, Query Processing Strategies

**Course Outcomes**

1. Understand retrieval of various categories of data from web
2. Understand the concept of recommender systems
3. Understand the concept of multimedia and distributed data retrieval

**Module I:**

Information Retrieval: Information Retrieval using Boolean model, processing Boolean queries, Tolerant Retrieval, Wildcard queries, Spelling Correction, Phonetic correction.

Information search: Index construction, Dynamic indexing, Index compression, vector space retrieval, Evaluation in information retrieval, Similarity search

**Module II:**

Probabilistic IR: Probabilistic Information retrieval, Language model of information retrieval, bottom up and Top down partitioning paradigms, Clustering and visualization via embedding

**Module III:**

Learning in IR: Supervised Learning, Evaluating Text classifiers, Nearest Neighbors Learners, Bayesian Learners, Hypertext Classification, Semi supervised Learning.

Cross lingual Query Management: Query Analysis, Machine Translation, Conceptual Machine Translation using WordNet, Case study on Cross Lingual Information Retrieval.

**Text Book:**

1. Introduction to Information Retrieval by Manning, Raghavan and Schutze, Cambridge University press, 2008.
2. Mining the Web, Discovering Knowledge from Hypertext Data, Soumen Chakrabarti, Allied Elsevier Publication, 2007

**Reference Book:**

1. Information Retrieval: Algorithms and Heuristics by David A. Grossman, Ophir Frieder, Second Edition, SPRINGER
2. Information Retrieval: Implementing and Evaluating Search Engines by Stefan Büttcher, Charles L. A. Clarke, Gordon V. Cormack, MIT Press, 2010
3. Information Retrieval: Searching in the 21st Century by Ayse Goker, John Davies, WILEY, 2009

**PE 4: Digital Forensics (PPECS207)**

**Module-1:**

Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues.

Understanding Computing Investigations – Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations.

**Module-2:**

Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.

Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case.

**Module-3:**

Current computer forensics tools- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

**Text Books:**

1. Warren G. Kruse II andJay G. Heiser**, “**Computer Forensics: Incident Response Essentials”, Addison Wesley, 2002.
2. Nelson, B, Phillips, A, Enfinger, F, Stuart, C., “Guide to Computer Forensics and Investigations, 2nd **e**d**.**, Thomson Course Technology, 2006, ISBN: 0-619-21706-5.

**Reference Books:**

1. Vacca, J, *Computer Forensics, Computer Crime Scene Investigation*, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

**Mini Project with Seminar (PPRIT201)**

**[To be Decided by the Department]**

**Lab 3: Software Engineering Lab (PLCIT201)**

**Prerequisites**

Object Oriented Techniques, UML

**Course Outcomes**

1. Understand requirement analysis and plan SRS based on their findings.
2. Understand and design ER Diagram, DFD and Structure Chart Diagram.
3. Design different UML diagrams.
4. Use different project development tools
5. Develop requirements specification for a given problem (Functional & Non- Functional)
6. Develop UML Use case model for a problem
7. Develop Class diagrams
8. Develop Sequence Diagrams
9. Develop Collaboration Diagrams
10. Develop Activity Diagram Diagrams
11. Develop State Chart Diagrams
12. Develop Deployment Diagrams
13. Develop code for the developed class model using Java & testing
14. Use a configuration management tool

**Lab 4: Computational Lab II (PLCIT202)**

**[To be decided by the department]**

**Audit -2**

**[To be decided by the Department]: Refer Appendix-II**

**Semester-3**

**PE 5: Software Testing (PPECS301)**

**Module-1:**

**INTRODUCTION:** Testing as an Engineering Activity – Testing as a Process – Testing axioms – Basic definitions – Software Testing Principles – The Tester’s Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design – Defect Examples – Developer/Tester Support of Developing a Defect Repository – Defect Prevention strategies.

**TEST CASE DESIGN:** Test case Design Strategies – Using Black Bod Approach to Test Case Design – Random Testing – Requirements based testing – Boundary Value Analysis – Equivalence Class Partitioning – State- based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing – Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Evaluating Test Adequacy Criteria.

**Module-2:**

**LEVELS OF TESTING:** The need for Levers of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination

System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing – Compatibility testing – Testing the documentation – Website testing.

**Module-3:**

**TEST MANAGEMENT:** People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – The role of three groups in Test Planning and Policy Development – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group.

**TEST AUTOMATION:** Software test automation – skill needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.

**TEXT BOOKS:**

1. Srinivasan Desikan and Gopalaswamy Ramesh, “Software Testing – Principles and Practices”, Pearson Education, 2006.

2. Ron Patton, “Software Testing”, Second Edition, Sams Publishing, Pearson Education, 2007.

**REFERENCES:**

* 1. Ilene Burnstein, “Practical Software Testing”, Springer International Edition, 2003.
	2. Edward Kit,” Software Testing in the Real World – Improving the Process”, Pearson Education, 1995.
	3. Boris Beizer,” Software Testing Techniques” – 2nd Edition, Van Nostrand Reinhold, New York, 1990.
	4. Aditya P. Mathur, “Foundations of Software Testing \_ Fundamental Algorithms and Techniques”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.

**PE 5: Digital Image Processing (PPEIE303)**

**Prerequisites:**

Basic knowledge in Digital Signal Processing, Knowledge of engineering mathematics including transform theory and matrix algebra is an advantage

**Course Outcomes:**

Students who successfully complete the course will be able to:

1. Review the fundamental concepts of a digital image processing system.

2. Analyze images in the frequency domain using various transforms.

3. Evaluate the techniques for image enhancement and image restoration.

4. Categorize various compression techniques.

5. Interpret Image compression standards.

6. Interpret image segmentation and representation techniques.

**Module I**

Introduction: Digital Image Fundamentals, Image Transforms: Fourier, Hadamard, Walsh, Discrete cosine and Hotelling Transforms.

Image Enhancement: Histogram modification, Histogram equalization, Smoothing, Filtering, Sharpening, Homomorphic filtering.

Image Restoration: Degradation Models, PSF, circulant and block - circulant matrices, deconvolution, restoration using inverse filtering, Wiener filtering and maximum entropy-based methods.

**Module II**

Image Segmentation: Pixel classification, Bi-level thresholding, Multi-level thresholding, P-tile method, Adaptive thresholding, Spectral & spatial classification, Edge detection, Hough transform, Region growing.

Image compression: Fundamental concepts of image compression - Compression models - Information theoretic perspective - Fundamental coding theorem - Lossless Compression: Huffman Coding- Arithmetic coding - Bit plane coding - Run length coding - Lossy compression: Transform coding - Image compression standards.

**Module III (10 Hours)**

Image Registration: Match measurement, Matching of binary pattern, Distortion tolerant matching, Applications of image registration techniques.

Morphological Image Processing: Dilation, Erosion, Duality, Opening, Closing, Hit-or-Miss Transformation, Basic morphological algorithm, Extraction of connected components, Thinning.

**Text Book:**

1. R. C. Gonzalez, R. E. Woods, Digital Image Processing, Pearson Education. II Edition.,2002
2. A.K. Jain, Fundamentals of digital image processing, Prentice Hall of India, 1989.

**Reference Book:**

1. W. K. Pratt, Digital image processing, Prentice Hall, 1989

**PE 5: Real Time Systems (PPEIT301)**

**Prerequisites**

Operating Systems, Computer Networks, Database

**Course Outcomes**

1. Develop real-time algorithm for task scheduling.
2. To understand the working of real-time operating systems and real-time database.
3. To work on design and development of protocols related to real-time communication.

**Module-1**

Introduction: What is real time, Applications of Real-Time systems, A basic model of Real-time system, Characteristics of Real-time system, Safety and Reliability, Types of Real-time tasks, timing constraints, Modeling timing constraints

Real-Time Task Scheduling: Some important concepts, Types of Real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA). Some issues Associated with RMA. Issues in using RMA practical situations

**Module-2**

Handling Resource Sharing and dependencies among Real-time Tasks: Resource sharing among real-time tasks, Priority inversion. Priority Inheritance Protocol (PIP), Highest Locker Protocol (HLP). Priority Ceiling Protocol (PCP). Different types of priority inversions under PCP. Important features of PCP, some issues in using a resource sharing protocol. Handling task dependencies

Scheduling Real-time tasks in multiprocessor and distributed systems: Multiprocessor task allocation, Dynamic allocation of tasks. Fault tolerant scheduling of tasks. Clock in distributed Real-time systems, Centralized clock synchronization

**Module-3**

Commercial Real-time operating systems: Time services, features of a Real-time operating system, Unix as a Real-time operating system, Unix-based Real-time operating systems, Windows as a Real-time operating system, POSIX-RT, A survey of contemporary Real-time operating systems. Benchmarking real-time systems

Real time Communication: Basic concepts, Examples of applications, Real-time communication in a LAN, Bounded Access protocol for LAN: IEEE 802.4, REHER, Real-time communication over packet switched networks, Routing, Resource Reservation

 Real-time Databases: Example applications of Real-time databases. Review of basic database concepts, Real-time databases, Characteristics of temporal data. Concurrency control in real-time databases, Commercial real-time databases

**Text Book:**

1. Real-time Systems Theory and Practice by Rajib Mall, Pearson Publication, 2008.

**Reference Book:**

1. Real-Time Systems by Jane W. S. Liu, Pearson Education, 2009.
2. Real-Time Systems by C.M. Krishna and K.G. Shin, TMH, 2010.

**PE 5: Intrusion Detection System (PPEIT302)**

**Prerequisites**

Operating System, Computer Networks

**Course Outcomes**

1. Obtain comprehensive knowledge on the subject of intrusion detection
2. Understand the state of the art of intrusion detection research
3. Get a hands-on exposure to the principles and techniques used in intrusion detection, as well as the technical challenges and fundamental limitations of intrusion detection

**Module-I:**

Intruder types, intrusion methods, processes and detection, message integrity and authentication, honeypots

General IDS model, data mining based IDS, Denning model, data mining framework for constructing features and models for intrusion detection systems

**Module-II:**

Unsupervised anomaly detection, CV5 clustering, SVM, probabilistic and statistical modeling, general IDS model and taxonomy, evaluation of IDS, cost sensitive IDS.

NBAD, specification based and rate based DDOS, scans/probes, predicting attacks, network based anomaly detection, stealthy surveillance detection; Defending against DOS attacks in scout: signature-based solutions, snort rules.

Host-based anomaly detection, taxonomy of security flaws in software, self-modeling system calls for intrusion detection with dynamic window size

**Module-III:**

Secure intrusion detection systems, network security, secure intrusion detection environment, secure policy manager, secure IDS sensor, alarm management, intrusion detection system signatures, sensor configuration, signature and intrusion detection configuration, IP blocking configuration, intrusion detection system architecture

**Text Books:**

1. Endorf, C., Schultz E. and Mellander J., “Intrusion Detection and Prevention,” McGraw-Hill.2003
2. Roberto Di Pietro, Luigi V. Mancini, Intrusion Detection System, Springer ,2008

**Reference Books**

1. Bhatnagar, K., “Cisco Security”, Course Technology. 2002
2. Marchette, D. J., “Computer Intrusion Detection and Network Monitoring: A Statistical Viewpoint”, Springer. 2001
3. Rash, M., Orebaugh, A. and Clark, G., “Intrusion Prevention and Active Response: Deploying Network and Host IPS”, Syngress. 2005
4. Cooper, M., Northcutt, S., Fearnow, M. and Frederick, K., “Intrusion Signatures and Analysis”, Sams. 2001

**Open Elective**

**[To be decided by the Department]: Refer Appendix-III**

**Project 1: (PPRIT301)**

**[To be decided by the Department]: Dissertation (Phase-I)**

**Semester-4**

**Project 2: (PPRIT401)**

**[To be decided by the Department]: Dissertation (Phase-II)**