M.TECH (CYBER FORENSICS & INFORMATION SECURITY)
Department of CSE, JNTUHCEH

COURSE STRUCTURE
(Applicable for the Batch admitted from the Academic Year 2018-19 onwards)

I SEMESTER

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TOTAL 16 0 8 18

Program Elective I
1. Information Security
2. Blockchain Technology
3. Ethical Hacking
4. Machine Learning

Program Elective II
1. Web & Database Security
2. Mobile Application Security
3. Social Media Security
4. Lightweight Cryptography

II SEMESTER

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Program Elective III
1. Cloud Computing Security
2. Privacy preserving Information Processing
3. Computer Security & Audit Assurance
4. Parallel Computing

Program Elective IV
1. Cyber Crime Investigation & Digital Forensics
2. Data Analytics for Fraud Detection
3. Digital Watermarking and Steganography
4. SOA & Micro-services
### III SEMESTER

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**Program Elective V**

1. Ad hoc and Sensor Networks
2. Cyber laws and Security Policies
3. Internet of Things
4. Social, Web and Mobile Analytics

### IV SEMESTER

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**Open Elective**

1. Information Security
2. Ethical Hacking

**Audit Course I & II**

1. English for Research paper writing
2. Soft Skills
3. Value Education
M.Tech CFIS I Semester

ADVANCED DATA STRUCTURES

Prerequisites
1. A course on “Data Structures”

Objectives
1. Introduces the heap data structures such as leftist heaps, binomial heaps, fibonacci and min-max heaps
2. Introduces a variety of data structures such as disjoint sets, hash tables, search structures and digital search structures

Outcomes
1. Ability to select the data structures that efficiently model the information in a problem
2. Ability to understand how the choice of data structures impact the performance of programs
3. Can Design programs using a variety of data structures, including hash tables, search structures and digital search structures

UNIT - I
Heap Structures
Introduction, Min-Max Heaps, Leftist trees, Binomial Heaps, Fibonacci heaps.

UNIT - II
Hashing and Collisions
Introduction, Hash Tables, Hash Functions, different Hash Functions:- Division Method, Multiplication Method, Mid-Square Method, Folding Method, Collisions

UNIT - III
Search Structures
OBST, AVL trees, Red-Black trees, Splay trees,
Multiway Search Trees
B-trees, 2-3 trees

UNIT - IV
Digital Search Structures
Digital Search trees, Binary tries and Patricia, Multiway Tries, Suffix trees, Standard Tries, Compressed Tries

UNIT - V
Pattern matching
Introduction, Brute force, the Boyer –Moore algorithm, Knuth-Morris-Pratt algorithm, Naïve String, Harspool, Rabin Karp

Textbooks:
1. Fundamentals of data structures in C++ Sahni, Horowitz, Mehatha, Universities Press.
2. Introduction to Algorithms, TH Cormen, PHI

References:
1. Design methods and analysis of Algorithms, SK Basu, PHI.
M.Tech CFIS I Semester

MATHEMATICAL FOUNDATIONS OF CRYPTOGRAPHY

Objectives

1. Build a solid mathematical basis to understand foundations of cryptography
2. Formally understand the notions related to security authentication and privacy.
3. Provide a rigorous treatment of the emerging and key subject subarea of CSE - security.

Outcomes

1. Students will gain an understanding of cryptosystems widely used to protect data security on the internet, and be able to apply the ideas in new situations as needed.

UNIT- I

Basic functions of cryptography - Encryption Schemes, Digital Signatures, Fault Tolerant Protocols and Zero-Knowledge Proofs
The Computational Model: $P$, $NP$, and NP-Completeness, Probabilistic Polynomial Time, Non-Uniform Polynomial Time

UNIT- II

Computational Difficulty
One-Way Functions Definitions, Strong One-Way Functions, Weak
One-Way Functions, Universal One-Way Function, Trapdoor One-Way Permutations
Computational Indistinguishability: Definition, Relation to Statistical Closeness, Indistinguishability by Repeated Experiments, Indistinguishability by Circuits

UNIT - III

Zero-Knowledge Proof Systems
Zero-Knowledge Proofs, Perfect and Computational Zero-Knowledge, An Example (Graph Isomorphism in PZK) Zero-Knowledge with Respect to Auxiliary Inputs

UNIT - IV

Encryption Schemes

UNIT- V

Digital Signatures and Message Authentication: Attacks and security, Variants
Constructions of Message Authentication Schemes: Applying a pseudorandom function to the document

Textbook:

References:
M.Tech CFIS I Semester

INFORMATION SECURITY
(Program Elective - I)

Prerequisites
1. A Course on “Computer Networks”
2. A Course on “Mathematics”

Objectives
1. To understand the fundamentals of Cryptography
2. To understand various key distribution and management schemes
3. To understand how to deploy encryption techniques to secure data in transit across data networks
4. To apply algorithms used for secure transactions in real world applications

Outcomes
1. Demonstrate the knowledge of cryptography, network security concepts and applications.
2. Ability to apply security principles in system design.
3. Ability to identify and investigate vulnerabilities and security threats and mechanisms to counter them

UNIT-I
Security Attacks
(Interruption, Interception, Modification and Fabrication),
Security Services
(Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security.

UNIT-II
Public key Cryptography
Message authentication and Hash Functions, Authentication Requirements and Functions, Message Authentication, Hash Functions and MACs Hash and MAC Algorithms SHA-512, HMAC.

UNIT-III
Digital Signatures
Email Security: Pretty Good Privacy (PGP) and S/MIME.
UNIT-IV
IP Security

Web Security
Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).

UNIT-V

Textbook

References:
M.Tech CFIS I Semester

**BLOCKCHAIN TECHNOLOGY**

*(Program Elective - I)*

**Prerequisites**

1. Knowledge in security and applied cryptography;
2. Knowledge in distributed databases

**Objectives**

1. Give an introduction to block chain technology and Cryptocurrency

**Outcomes**

1. Learn about research advances related to one of the most popular technological areas today.

**UNIT- I**

**Introduction**

Block chain or distributed trust, Protocol, Currency, Cryptocurrency, How a Cryptocurrency works, Crowdfunding

**UNIT- II**

**Extensibility of Blockchain concepts**

Digital Identity verification, Block chain Neutrality, Digital art, Blockchain Environment

**UNIT- III**

**Blockchain Science**

Gridcoin, Folding coin, Blockchain Genomics, Bitcoin MOOCs

**UNIT - IV**

**Currency**

Token, Tokenizing, Campuscoin, Coindrop as a strategy for Public adoption, Currency Multiplicity, Demurrage currency

**UNIT - V**

**Technical challenges**

Business model challenges, Scandals and Public perception, Government Regulations

**Text Books**

1. Blockchain Blueprint for Economy, Melanie Swan, SPD Oreilly.

**References**

ETHICAL HACKING
(Program Elective - I)

Prerequisites
1. A course on “Operating Systems”
2. A course on “Computer Networks”
3. A course on “Network Security and Cryptography”

Objectives
1. The aim of the course is to introduce the methodologies and framework of ethical hacking for enhancing the security.
2. The course includes Impacts of Hacking; Types of Hackers; Information Security Models; Information Security Program; Business Perspective; Planning a Controlled Attack; Framework of Steps (Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Deliverable and Integration)

Outcomes
1. Gain the knowledge of the use and availability of tools to support an ethical hack
2. Gain the knowledge of interpreting the results of a controlled attack
3. Understand the role of politics, inherent and imposed limitations and metrics for planning of a test
4. Comprehend the dangers associated with penetration testing

UNIT- I
Introduction
Hacking Impacts, The Hacker

Framework
Planning the test, Sound Operations, Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Final Analysis, Deliverable, Integration

Information Security Models

Information Security Program
The Process of Information Security, Component Parts of Information Security Program, Risk Analysis and Ethical Hacking

UNIT - II
The Business Perspective
Business Objectives, Security Policy, Previous Test Results, Business Challenges

Planning for a Controlled Attack
Inherent Limitations, Imposed Limitations, Timing is Everything, Attack Type, Source Point, Required Knowledge, Multi-Phased Attacks, Teaming and Attack Structure, Engagement Planner, The Right Security Consultant, The Tester, Logistics, Intermediates, Law Enforcement

UNIT - III
Preparing for a Hack - Technical Preparation, Managing the Engagement
Reconnaissance - Social Engineering, Physical Security, Internet Reconnaissance

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Introduction
Hacking Impacts, The Hacker

Framework
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Information Security Models

Information Security Program
The Process of Information Security, Component Parts of Information Security Program, Risk Analysis and Ethical Hacking

UNIT - II
The Business Perspective
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Inherent Limitations, Imposed Limitations, Timing is Everything, Attack Type, Source Point, Required Knowledge, Multi-Phased Attacks, Teaming and Attack Structure, Engagement Planner, The Right Security Consultant, The Tester, Logistics, Intermediates, Law Enforcement

UNIT - III
Preparing for a Hack - Technical Preparation, Managing the Engagement
Reconnaissance - Social Engineering, Physical Security, Internet Reconnaissance
UNIT - IV
Enumeration
Enumeration Techniques, Soft Objective, Looking Around or Attack, Elements of Enumeration, Preparing for the Next Phase

Exploitation
Intuitive Testing, Evasion, Threads and Groups, Operating Systems, Password Crackers, RootKits, applications, Wardialing, Network, Services and Areas of Concern

UNIT - V
Deliverable
The Deliverable, The Document, Overall Structure, Aligning Findings, Presentation

Integration
Integrating the Results, Integration Summary, Mitigation, Defense Planning, Incident Management, Security Policy, Conclusion

Textbook:

References:
1. Ethical Hacking and Countermeasures Attack Phases, EC-Council, Cengage Learning
M.Tech CFIS I Semester

MACHINE LEARNING
(Program Elective - I)

Prerequisites
1. A Course on “Data Structures”
2. Knowledge on statistical methods

Objectives
1. This course explains machine learning techniques such as decision tree learning, Bayesian learning etc.
2. To understand computational learning theory.
3. To study the pattern comparison techniques.

Outcomes
1. Understand the concepts of computational intelligence like machine learning
2. Ability to get the skill to apply machine learning techniques to address the real time problems in different areas
3. Understand the Neural Networks and its usage in machine learning application.

UNIT - I
Introduction - Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning

Concept learning and the general to specific ordering – introduction, a concept learning task, concept learning as search, find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, remarks on version spaces and candidate elimination, inductive bias.

Decision Tree Learning – Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.

UNIT - II
Artificial Neural Networks-1– Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm.


Evaluation Hypotheses – Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.

UNIT - III
Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, the EM algorithm.

Computational learning theory – Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis space, sample complexity for infinite hypothesis spaces, the mistake bound model of learning.
Instance-Based Learning - Introduction, $k$-nearest neighbour algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

UNIT- IV

Genetic Algorithms – Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms.


Reinforcement Learning – Introduction, the learning task, $Q$-learning, non-deterministic, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

UNIT - V

Analytical Learning-1 - Introduction, learning with perfect domain theories: PROLOG-EBG, remarks on explanation-based learning, explanation-based learning of search control knowledge.

Analytical Learning-2 - Using prior knowledge to alter the search objective, using prior knowledge to augment search operators.

Combining Inductive and Analytical Learning – Motivation, inductive-analytical approaches to learning, using prior knowledge to initialize the hypothesis.

Textbook:

Reference:
M.Tech CFIS I Semester

WEB & DATABASE SECURITY
(Program Elective - II)

Objectives
1. Give an Overview of information security
2. Give an overview of Access control of relational databases

Outcomes
Students should be able to
1. Understand the Web architecture and applications
2. Understand client side and service side programming
3. Understand how common mistakes can be bypassed and exploit the application
4. Identify common application vulnerabilities

UNIT - I
The Web Security
The Web Security Problem ,Risk Analysis and Best Practices

UNIT - II
The Web Privacy

UNIT - III
Database Security
Recent Advances in Access Control, Access Control Models for XML, Database Issues in Trust Management and Trust Negotiation, Security in Data Warehouses and OLAP Systems

UNIT - IV
Security Re-engineering for Databases

UNIT - V
Future Trends Privacy in Database Publishing
A Bayesian Perspective, Privacy-enhanced Location-based Access Control , Efficiently Enforcing the Security and Privacy Policies in a Mobile Environment

Text Books
1. Web Security ,Privacy and Commerce ,Simson GArfinkel, Gene Spafford,O’Reilly 
2. Handbook on Database security applications and trends ,Michael Gertz, Sushil Jajodia
Prerequisites
1. Undergraduate level knowledge of Network Security

Objectives
1. Gain in-depth knowledge on mobile security and its relation to the new security based protocols.
2. Apply proactive and defensive measures to counter potential threats, attacks and intrusions.

Outcomes
1. By the end of this course students will be able to learn security based protocols, attacks and intrusions

UNIT-I
Top Mobile Issues and Development Strategies:

UNIT-II
WAP and Mobile HTML Security
WAP and Mobile HTML Basics, Authentication on WAP/Mobile HTML Sites, Encryption, Application Attacks on Mobile HTML Sites, Cross-Site Scripting, SQL Injection, Cross-Site Request Forgery, HTTP Redirects, Phishing, Session Fixation, Non-SSL Login, WAP and Mobile Browser Weaknesses, Lack of HTTP Only Flag Support, Lack of SECURE Flag Support, Handling Browser Cache, WAP Limitations.

UNIT-III
Bluetooth Security

UNIT-IV
SMS Security
UNIT-V
Enterprise Security on the Mobile OS

Textbook:
1. Mobile Application Security, Himanshu Dwivedi, Chris Clark, David Thiel, TATA McGRAW-Hill.

References:
M.Tech CFIS I Semester

SOCIAL MEDIA SECURITY
(Program Elective – II)

Objectives
1. Give introduction about the networks, its use, the need of security

Outcomes
1. Learn about browser’s risks
2. Learn about Social Networking, Understands the risks while using social media.
   Guidelines for social networking
3. Understand how to secure different web browsers.
4. Understand how an e-mail works does; learn threats involved using an email communication, safety measures while using e-mail.

UNIT - I
Introduction to Social Media, Understanding Social Media, Different Types and Classifications, The Value of Social Media, Cutting Edge Versus Bleeding Edge, The Problems That Come With Social Media, Is Security Really an Issue? Taking the Good With the Bad

UNIT - II
Dark side
Cyber crime, Social Engineering, Hacked accounts, cyberstalking, cyberbullying, predators, phishing, hackers

UNIT - III
Being bold versus being overlooked
Good social media campaigns, Bad social media campaigns, Sometimes it’s better to be overlooked, Social media hoaxes, The human factor, Content management, Promotion of social media

UNIT - IV
Risks of Social media
Introduction Public embarrassment, Once it’s out there, it’s out there False information, Information leakage, Retention and archiving, Loss of data and equipment

UNIT - V
Policies and Privacy
Blocking users controlling app privacy, Location awareness, Security Fake accounts passwords, privacy and information sharing

Textbooks:
1. Interdisciplinary Impact Analysis of Privacy in Social Networks, Recognizing Your Digital Friends, Encryption for Peer-to-Peer Social Networks, Crowdsourcing and Ethics, Authors: Altshuler Y, Elovici Y, Cremers A.B, Aharony N, Pentland A. (Eds.)
2. Social media security
M.Tech CFIS I Semester

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LIGHTWEIGHT CRYPTOGRAPHY
(Program Elective - II)

Prerequisites
1. Undergraduate level knowledge of Network Security

Objectives
1. Gain in-depth knowledge on Lightweight Cryptography and its relation to the new security in RFID tags
2. Apply proactive and defensive measures to counter potential threats, attacks and intrusions.

Outcomes
1. Ability to learn Cryptographic based solutions, attacks and intrusions.
2. Understand security and privacy issues in radio frequency identification (RFID) systems.
3. Understanding multiple ways to attack and defend in industrial systems.

UNIT – I

UNIT –II

UNIT – III
Network Based Solutions - EPC System for a Safe & Secure Supply Chain and How it is Applied, The Potential of RFID and NFC in Anti-Counterfeiting, Improving the Safety and Security of the Pharmaceutical Supply Chain.

UNIT- IV

UNIT – V
Low-cost Cryptraphic solutions : A Random Number Generator for Application in RFID Tags, A Low Cost Solution to Cloning and Authentication Based on a Lightweight Primitive, Lightweight Cryptography for Low Cost RFID.

Text book

References
1. RFID Security and Privacy by Yingjiu Li, Robert H. Deng
2. RFID HANDBOOK by Klaus Finkenzeller, Third edition Wiley Publications
M.Tech CFIS I Semester

ADVANCED DATA STRUCTURES LAB

Prerequisites
1. A course on “Computer Programming & Data Structures”

Objectives
1. Introduces the basic concepts of Abstract Data Types.
2. Reviews basic data structures such as stacks and queues.
3. Introduces a variety of data structures such as hash tables, search trees, tries, heaps, graphs, and B-trees.
4. Introduces sorting and pattern matching algorithms

Outcomes
1. Ability to select the data structures that efficiently model the information in a problem.
2. Ability to assess efficiency trade-offs among different data structure implementations or combinations.
3. Implement and know the application of algorithms for sorting and pattern matching.
4. Design programs using a variety of data structures, including hash tables, binary and general tree structures, search trees, tries, heaps, graphs, and B-trees.

List of Programs
1. Write a program to perform the following operations:
   a) Insert an element into a binary search tree.
   b) Delete an element from a binary search tree.
   c) Search for a key element in a binary search tree.

2. Write a program for implementing the following sorting methods:
   a) Merge sort  
   b) Heap sort  
   c) Quick sort

3. Write a program to perform the following operations:
   a) Insert an element into a B-tree.
   b) Delete an element from a B-tree.
   c) Search for a key element in a B-tree.

4. Write a program to perform the following operations:
   a) Insert an element into a Min-Max heap
   b) Delete an element from a Min-Max heap
   c) Search for a key element in a Min-Max heap

5. Write a program to perform the following operations:
   a) Insert an element into a Leftist tree
   b) Delete an element from a Leftist tree
   c) Search for a key element in a Leftist tree

6. Write a program to perform the following operations:
   a) Insert an element into a binomial heap
   b) Delete an element from a binomial heap.
   c) Search for a key element in a binomial heap

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7. Write a program to perform the following operations:
   a) Insert an element into an AVL tree.
   b) Delete an element from an AVL search tree.
   c) Search for a key element in an AVL search tree.

8. Write a program to perform the following operations:
   a) Insert an element into a Red-Black tree.
   b) Delete an element from a Red-Black tree.
   c) Search for a key element in a Red-Black tree.

9. Write a program to implement all the functions of a dictionary using hashing.
10. Write a program for implementing Knuth-Morris-Pratt pattern matching algorithm.
11. Write a program for implementing Brute Force pattern matching algorithm.
12. Write a program for implementing Boyer pattern matching algorithm.

Textbooks:

3. Introduction to Data Structures in C, Ashok Kamthane

References:

1. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/Pearson Education
M.Tech CFIS I Semester

INFORMATION SECURITY LAB

Prerequisites
1. A Course on “Computer Networks”

Co-requisite
1. A course on “Network Security and Cryptography”

Objectives
1. To get practical exposure of Cryptography algorithms

Outcomes
1. Get the skill to provide security services like authentication confidentiality to the real systems.
2. Get the knowledge to solve security issues in day to day life.

List of Experiments
1. Perform an Experiment for port scanning with nmap
2. Setup a honepot and monitor the honipot on the network
3. Install a jcrpt tool(or any other equivalent) and demonstrate Asymmetric, Symmetric crypto algorithm, Hash and Digital/ PKI signatures studied in theory Network security and management
4. Using snort perform realtime traffic analysis and packet logging
5. Generate minimum 10 passwords of length 12 characters using open ssl command
6. Perform practical approach to implement Footprinting-Gathering target information using Dmitry-Dmagic, UAtester
7. Write a program to perform encryption and decryption using the following substitution ciphers.
8. Caesar cipher
9. Play fair cipher
10. Hill Cipher
11. Write a program to implement the DES algorithm.
12. Write a program to implement RSA algorithm.
13. Calculate the message digest of a text using the SHA-1 algorithm.
15. Configuring S/MIME for email communication.
16. Using Snort, perform real time traffic analysis and packet logging.

Textbook:

References:
M.Tech CFIS I Semester

BLOCKCHAIN TECHNOLOGY LAB

Objectives
1. The main objective of this course is to provide the knowledge in implementing Blockchains using hash algorithms and bitcoins generation.

Outcomes
1. By the end of this course students will be able to learn various Hash Algorithms and generation of Bitcoins.

List of Experiments
1. Implement Block hash using SHA-256 algorithm using java code or python code.
2. Implement Message authentication using Java code or Python code.
3. Implement MD5 algorithm using Java code or python code.
4. Implement RIPEMD-160 algorithm using Java code or python code.
5. Implement Whirlpool algorithm using Java code or python code.
6. Write a case study how the Bitcoins were generated and implemented.

Textbook
1. Blockchain Blueprint for Economy, Melanie Swan, SPD Oreilly

References
M.Tech CFIS I Semester

ETHICAL HACKING LAB

Objectives

1. The aim of the course is to introduce the methodologies framework tools of ethical hacking to get awareness in enhancing the security
2. To get knowledge on various attacks and their detection

Outcomes

1. Gain the knowledge of the use and availability of tools to support an ethical hack
2. Gain the knowledge of interpreting the results of a controlled attack

List of Experiments

1. Setup a honey pot and monitor the honey pot on network
2. Write a script or code to demonstrate SQL injection attacks
3. Create a social networking website login page using phishing techniques
4. Write a code to demonstrate DoS attacks
5. Install rootkits and study variety of options
6. Study of Techniques uses for Web Based Password Capturing.
7. Install jcrypt tool (or any other equivalent) and demonstrate Asymmetric, Symmetric Crypto algorithm, Hash and Digital/PKI signatures studied in theory Network Security And Management
8. Implement Passive scanning, active scanning, session hijacking, cookies extraction using Burp suit tool
M.Tech CFIS I Semester  

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MACHINE LEARNING LAB

Objective

1. To get an overview of the various machine learning techniques.

Outcomes

1. Understand complexity of Machine Learning algorithms and their limitations;
2. Understand modern notions in data analysis oriented computing;
3. Be capable of confidently applying common Machine Learning algorithms in practice and implementing their own;
4. Be capable of performing experiments in Machine Learning using real-world data.

List of Experiments

1. The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is the probability that a student is absent given that today is Friday?
2. Extract the data from database
3. Implement k-nearest neighbours classification
4. Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k-means clustering with 3 means (i.e., 3 centroids)

<table>
<thead>
<tr>
<th>VAR1</th>
<th>VAR2</th>
<th>CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.713</td>
<td>1.586</td>
<td>0</td>
</tr>
<tr>
<td>0.180</td>
<td>1.786</td>
<td>1</td>
</tr>
<tr>
<td>0.353</td>
<td>1.240</td>
<td>1</td>
</tr>
<tr>
<td>0.940</td>
<td>1.566</td>
<td>0</td>
</tr>
<tr>
<td>1.486</td>
<td>0.759</td>
<td>1</td>
</tr>
<tr>
<td>1.266</td>
<td>1.106</td>
<td>0</td>
</tr>
<tr>
<td>1.540</td>
<td>0.419</td>
<td>1</td>
</tr>
<tr>
<td>0.459</td>
<td>1.799</td>
<td>1</td>
</tr>
<tr>
<td>0.773</td>
<td>0.186</td>
<td>1</td>
</tr>
</tbody>
</table>

5. The following training examples map descriptions of individuals onto high, medium and low credit-worthiness.

medium skiing design single twenties no -> highRisk
high golf trading married forties yes -> lowRisk
low speedway transport married thirties yes -> medRisk
medium football banking single thirties yes -> lowRisk
high flying media married fifties yes -> highRisk
low football security single twenties no -> medRisk
medium golf media single thirties yes -> medRisk
medium golf transport married forties yes -> lowRisk
high skiing banking single thirties yes -> highRisk
low golf unemployed married forties yes -> highRisk

Input attributes are (from left to right) income, recreation, job, status, age-group, home-owner. Find the unconditional probability of `golf' and the conditional probability of `single' given `medRisk' in the dataset.
6. Implement linear regression.
7. Implement Naïve Bayes theorem to classify the English text.
8. Implement an algorithm to demonstrate the significance of genetic algorithm.
9. Implement the finite words classification system using Back-propagation algorithm.

**Textbook:**

1. Machine Learning – Tom M. Mitchell, - MGH

**Reference:**

M.Tech CFIS I Semester

RESEARCH METHODOLOGIES & IPR

Objectives
1. Introduce research paper writing and induce paper publication skills.
2. Give the introduction to Intellectual Property Rights

Outcomes
1. Ability to distinguish research methods
2. Ability to write and publish a technical research paper
3. Ability to review papers effectively
4. IPR and Patent filing

UNIT – I
Introduction
Objective of Research; Definition and Motivation; Types of Research; Research Approaches; Steps in Research Process; Criteria of Good Research; Ethics in Research.

Research Formulation and Literature Review
Problem Definition and Formulation; Literature Review; Characteristics of Good Research Question; Literature Review Process.

UNIT – II
Data Collection
Primary and Secondary Data; Primary and Secondary Data Sources; Data Collection Methods; Data Processing; Classification of Data.

Data Analysis
Statistical Analysis; Multivariate Analysis; Correlation Analysis; Regression Analysis; Principle Component Analysis; Samplings;

UNIT – III
Research Design
Need for Research Design; Features of a Good Design; Types of Research Designs; Induction and Deduction.

Hypothesis Formulation and Testing
Hypothesis; Important Terms; Types of Research Hypothesis; Hypothesis Testing; Z-Test; t-Test; f-Test; Making a Decision; Types of Errors; ROC Graphics.

UNIT – IV
Test Procedures
Parametric and Non Parametric Tests; ANOVA; Mann-Whitney Test; Kruskal-Wallis Test; Chi-Square Test; Multi-Variate Analysis.
Presentation of the Research Work
Business Report; Technical Report; Research Report; General Tips for Writing Report; Presentation of Data; Oral Presentation; Bibliography and References; Intellectual Property Rights; Open-Access Initiatives; Plagiarism.

UNIT – V
Law of Patents, Patent Searches, Ownership, Transfer

Patent Infringement, New Developments and International Patent Law

Textbooks
1. Research Methodology. Methods & Technique, Kothari. C.R.
2. Research Methodology, S.S Vinod Chandra, S Anand Hareendran, Pearson

References
2. A Hand Book of Education Research, NCTE
5. Statistical Methods, Y.P. Agarwal.
Prerequisites
1. A course on “Computer Programming & Data Structures”
2. A course on “Advanced Data Structures & Algorithms”

Objectives
1. Introduces the recurrence relations for analyzing the algorithms
2. Introduces the graphs and their traversals.
3. Describes major algorithmic techniques (divide-and-conquer, greedy, dynamic programming, Brute Force, Transform and Conquer approaches) and mention problems for which each technique is appropriate;
4. Describes how to evaluate and compare different algorithms using worst-case, average-case and best-case analysis.
5. Introduces string matching algorithms
6. Introduces linear programming.

Outcomes
1. Ability to analyze the performance of algorithms
2. Ability to choose appropriate data structures and algorithm design methods for a specified application
3. Ability to understand how the choice of data structures and the algorithm design methods impact the performance of programs

UNIT – I
Classification of algorithms, Algorithm Specifications
Mathematical analysis of Recursive Algorithms: – Introduction to recurrence equations, formulation of recurrence equations, Techniques for solving recurrence equations, Solving recurrence equations, Solving Recurrence Equations using polynomial reduction, Divide and conquer recurrences

UNIT – II
Graphs
Graph representations, Graph traversals

Brute Force Approaches
Computational Geometry Problems-Closest pair problem, Convex Hull Problem, Exhaustive Searching- Magic Squares problem, Container Loading problem, Knapsack Problem, Assignment Problem

UNIT – III
Divide and Conquer approach
Multiplication of long integers, Strassen’s matrix multiplication, Fourier Transform

Greedy algorithms
Coin change problem, Scheduling problems, knapsack problem, optimal storage on tapes, optimal tree problems, optimal graph problems
UNIT – IV
Transform and Conquer approach
Matrix operations- Gaussian Elimination method, LU decomposition, Crout’s method of decomposition

Dynamic Programming
Computing binomial coefficients, Multistage graph problem, Transitive Closure and Warshall algorithm, Floyd warshall all pairs shortest path problem, TSP, Flow shop scheduling algorithm

UNIT – V
String algorithms
Basic string algorithms, Longest Common Subsequences.

Linear Programming, Graphical method for solving LPP, Simplex method, Minimization problems, Principle of Duality, Max Flow problem

Text Books
1. Design and Analysis of Algorithms, S.Sridhar, OXFORD University Press

References
3. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education
M.Tech CFIS II Semester

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SYSTEMS AND NETWORK SECURITY

Prerequisites
1. A Course on “Computer Networks”
2. A Course on ”Network Security”

Objectives
1. A brief explanation of the objective is to provide knowledge on different types of Intrusions occur at various Network levels, and level of security provisions required when the systems are used at different networks in LAN, WAN

Outcomes
1. Students will get the knowledge in detection, protection of Intrusions.
2. It gives an opportunity to students to get awareness on the level of security required for a system in Intranet, Internet, cellular networks

UNIT - I
Detecting System Intrusions
Monitoring Key Files in the System, Zero Day attacks, Fullpacket capture devices, Data correlation, SEIM, Network-Based Detection of System Intrusions

Preventing System Intrusions
Symptoms of Intrusions, Security policies, Risk Analysis, Controlling user Access, Intrusion Prevention capabilities

UNIT - II
Guarding Against Network Intrusions
Traditional Reconnaissance and Attacks, Malicious Software, Defense in Depth, Preventive Measures, Intrusion Monitoring and Detection, Reactive Measures, Network-Based Intrusion Protection

Internet Security - Internet Protocol Architecture, Internet Threat Model, Defending against Attacks on the Internet, Internet Security Checklist

UNIT - III
Intranet Security

UNIT - IV
Local Area Network Security

UNIT - V
RFID Security - RFID challenges, RFID protections

Text Books
CLOUD COMPUTING SECURITY  
(Program Elective - III)

Objectives

1. Guiding Security design principles for Cloud Computing
2. Be able to understand the legal, security, forensics, personal & data privacy issues within Cloud environment
3. Understand the concepts and guiding principles for designing and implementing appropriate safeguards and countermeasures for Cloud based IT services

Outcomes

1. Approaches to designing cloud services that meets essential Cloud infrastructure characteristics on demand computing, shared resources, elasticity and measuring usage.
2. Design security architectures that assures secure isolation of physical and logical infrastructures
3. Understand the industry security standards, regulatory mandates, audit policies and compliance requirements for Cloud based infrastructures.

UNIT - I
Introduction to cloud – Basic Concepts and Terminology – Concepts and Models of cloud computing – Cloud delivery and deployment models.

UNIT - II
Cloud enablers and security – Internet, Broadband, Data centre and virtualization technologies

UNIT - III
Web and Multitenant services – Cloud security,

UNIT - IV
Agent threats: Cloud infrastructure mechanisms, Specialized cloud mechanisms,

UNIT - V
Cloud Management and Cloud Security. AWS, Azure and Google case study

Text Books


References

M.Tech CFIS II Semester

PRIVACY PRESERVING INFORMATION PROCESSING
(Program Elective - III)

Objectives
1. Techniques in protecting data privacy and data security when the data is released to public.

Outcomes
1. To get knowledge in various data privacy issues and their preventions

UNIT - I
Malware
Exploring Timeline-Based Malware Classification, Screening Smartphone Applications Using Behavioural Signatures.

Authentication and Authorization
Evolving a Secure Internet, Enhancing Click-Draw Based Graphical Passwords Using Multi-Touch on Mobile Phones, Applying DAC Principles to the RDF Graph Data Model

UNIT - II
Network Security/ Cryptography
Extraction of ABNF Rules from RFCs to Enable Automated Test Data Generation, Key Derivation Function: The SCKDF Scheme

UNIT - III
Software Security
Improving Mobile Device Security with Operating System-Level Virtualization, Generating Realistic Application Workloads for Mix-Based Systems for Controllable, Repeatable and Usable Experimentation

UNIT - IV
Privacy Protection

UNIT - V
Risk Analysis and Security Metrics
Using the Conflicting Incentives Risk Analysis Method Performance Analysis of Scalable Attack Representation Models

Security Management/Forensic
Secure Outsourcing: An Investigation of the Fit between Clients and Providers

Text Books
1. Security and privacy protection in information processing systems by Lech J. Janczewski, Henry B. Wolfe, Sujeet Shenoi
M.Tech CFIS II Semester

COMPUTER SECURITY & AUDIT ASSURANCE
(Program Elective - III)

Objectives
1. To introduce the fundamental concepts and techniques in computer and network security,
2. An overview of information security and auditing, and to expose students to the latest trend of computer attack and defence

Outcomes
1. Describe fundamental concepts of information security and systems auditing
2. Analyze the latest trend of computer security threats and defence
3. Identify security weaknesses in information systems, and rectify them with appropriate security mechanisms
4. Explain the security controls in the aspects of physical, logical and operational security control

UNIT - I
System Audit and Assurance – Characteristics of Assurance services, Types of Assurances services, Certified Information system auditor, Benefits of Audits for Organization, COBIT

UNIT - II
Internal Control and Information system Audit - Internal Control, Detective control, Corrective Control, Computer Assisted Audit Tools and Techniques

UNIT - III
Conducting Audit – Standard practices, policies, Audit planning, Risk Assessment, Information gathering techniques, Vulnerabilities, System security testing, conducting Audits for Banks

UNIT - IV
Network Security and Control, Internet Banking Risks and Control, Operating System Risks and Control, Operational Control Overview

UNIT - V
Business Continuity and Disaster Recovery Planning Control – Databackup/storage, Developing appropriate Disaster recovering strategy, Business Impact analysis

Text Books
1. Information System Audit and Assurance, D. P. Dube, Ved Prakash Gulati; Tata McGraw-Hill Education, 01-Jan2005
2. Auditing IT Infrastructures for Compliance, Martin Weiss, Michael G. Solomon; Jones & Bartlett Publishers, 10Jul-2015
PARALLEL COMPUTING  
(Program Elective - III)

Prerequisites
1. A Course on “Computer Organization & Architecture”
2. A Course on “Operating Systems”
3. A Course on “Computer Programming”

Objectives
1. To introduce the foundations of parallel Computing
2. To learn various parallel computing architectures and programming models
3. To gain knowledge of writing efficient parallel programs

Outcomes
1. Ability to understand the concepts of parallel architectures
2. Ability to select the data structures that efficiently model the information in a problem.
3. Ability to develop an efficient parallel algorithm to solve it.
4. Ability to implement an efficient and correct code to solve it, analyse its performance

UNIT - I
Parallel Computing
Introduction, Motivation and scope - Parallel Programming Platforms – Basic Communication Operations

UNIT - II
Principles of Parallel Algorithm Design - Analytical Modelling of Parallel Programs

UNIT - III
Programming using Message Passing Paradigm (MPI) - Programming Shared Address Space Platforms (PThreads)

UNIT - IV
Dense Matric Algorithms ( Matrix-Vector Multiplication , Matrix-Matrix Multiplication) Sorting Algorithms ( Issues, Bubble Sort, Quick Sort, Bucket Sort, Enumeration Sort, Radix Sort)

UNIT - V
Graph Algorithms ( Minimum Spanning Tree: Prim's Algorithm  
Single-Source Shortest Paths: Dijkstra's Algorithm ) Search Algorithms ( DFS, BFS)

Textbook

References
2. Parallel Computers – Architectures and Programming, V. Rajaraman, C. Siva Ram Murthy, PHI.
M.Tech CFIS II Semester

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**CYBER CRIME INVESTIGATION & DIGITAL FORENSICS**
*(Program Elective - IV)*

**Prerequisites**
1. Knowledge of information technology fundamentals (computer hardware, operating systems, applications and networking) is required.

**Objectives**
1. An introduction to the methodology and procedures associated with digital forensic analysis in a network environment

**Outcomes**
1. Obtain and analyze digital information for possible use as evidence in civil, criminal or administrative cases.
2. They will learn about the importance of digital forensic principles and procedures, legal considerations, digital evidence controls

**UNIT – I**
The Role of computers in crime, Cyber Crime Law

**UNIT – II**

**UNIT - III**
Voilent Crime and Digital Investigation : The role of Computers in violent crime , Processing Digital crime scene , Investigative Reconstruction ,Digital Evidence as Alibi

**UNIT - IV**
Cyberstalking , Computer basics for Digital Forensics , Applying Forensics science to computers, Digital Evidence on windows systems, Digital Evidence on unix systems

**UNIT - V**

**Text Books**
M.Tech CFIS II Semester

DATA ANALYTICS FOR FRAUD DETECTION
(Program Elective - IV)

Objectives

1. Discuss the overall process of how data analytics is applied
2. Discuss how data analytics can be used to better address and identify risks
3. Help mitigate risks from fraud and waste for our clients and organizations

Outcomes

1. Formulate reasons for using data analysis to detect fraud.
2. Explain characteristics and components of the data and assess its completeness.
3. Identify known fraud symptoms and use digital analysis to identify unknown fraud symptoms.
4. Automate the detection process.
5. Verify results and understand how to prosecute fraud

UNIT - I
Introduction: Defining Fraud, Anomalies versus Fraud, Types of Fraud, Assess the Risk of Fraud, Fraud Detection, Recognizing Fraud, Data Mining versus Data Analysis and Analytics, Data Analytical Software, Anomalies versus Fraud within Data, Fraudulent Data Inclusions and Deletions

UNIT - II
The Data Analysis Cycle, Evaluation and Analysis, Obtaining Data Files, Performing the Audit, File Format Types, Preparation for Data Analysis, Arranging and Organizing Data, Statistics and Sampling, Descriptive Statistics, Inferential Statistics

UNIT - III
Data Analytical Tests, Benford’s Law, Number Duplication Test, Z-Score, Relative Size Factor Test, Same-Same-Same Test, Same-Same-Different Test

UNIT - IV
Advanced Data Analytical Tests
Correlation, Trend Analysis, GEL-1 and GEL-2, Skimming and Cash Larceny, Billing schemes, and Data Familiarization, Benford’s Law Tests, Relative Size Factor Test, Match Employee Address to Supplier data

UNIT - V
Payroll Fraud, Expense Reimbursement Schemes, Register disbursement schemes

Textbook:

1. Fraud and Fraud Detection: A Data Analytics Approach by Sunder Gee, Wiley
M.Tech CFIS II Semester

DIGITAL WATERMARKING AND STEGANOGRAPHY
(Program Elective - IV)

Objectives
1. To learn about the watermarking models and message coding
2. To learn about watermark security and authentication.
3. To learn about steganography Perceptual models

Outcomes
1. Know the History and importance of watermarking and steganography
2. Analyze Applications and properties of watermarking and steganography
3. Demonstrate Models and algorithms of watermarking
4. Possess the passion for acquiring knowledge and skill in preserving authentication of Information
5. Identify theoretic foundations of steganography and steganalysis

UNIT - I
Introduction

Watermarking models & message coding

UNIT - II
Watermarking with side information & analyzing errors

UNIT - III
Perceptual models
Evaluating perceptual impact – General form of a perceptual model – Examples of perceptual models – Robust watermarking approaches - Redundant Embedding, Spread Spectrum Coding, Embedding in Perceptually significant coefficients

UNIT - IV
Watermark security & authentication

UNIT - V
Steganography
Steganography communication – Notation and terminology – Information-theoretic foundations of steganography – Practical steganographic methods – Minimizing the embedding impact – Steganalysis


Text Books


M.Tech CFIS II Semester

SOA & MICRO-SERVICES
(Program Elective - IV)

Pre-requisites:
The course assumes a reasonable comfort and background about Information Technology and Management Information Systems.

Objectives
1. To gain understanding of the basic principles of service orientation
2. To learn service oriented analysis techniques
3. To learn technology underlying the service design
4. To learn the concepts such as SOAP, Registering and Discovering Services.

Outcomes
At the end of this course, students are expected to gain the following learning:
1. Get the foundations and concepts of service based computing
2. Advocate the importance and means of technology alignment with business
3. Understanding the basic operational model of web services,
4. Gain the knowledge of key technologies in the service oriented computing arena
5. Apply and practice the learning through a real or illustrative project/case study.

UNIT - I
Software Architecture: Need for Software Architecture, Objectives of Software Architecture, Types of Information Technology (IT) Architecture, Architectural Patterns and Styles

UNIT - II

UNIT - III
Service-Oriented Applications: Considerations for Service-oriented Applications, Patterns for SOA, Pattern-based Architecture for Service-oriented Applications, Composite Applications, Composite Application Programming Model
Service-Oriented Analysis and Design: Need for Models, Principles of Service Design Non-functional Properties for Services, Design of Activity Services (or Business Services) Design of Data Services, Design of Client Services, Design of Business Process Services
UNIT - IV

**Cloud and MSA**: Cloud Services, Hybrid Cloud Services, Considerations for Hybrid Cloud Services, Cloud Services and MSA, MSA for SMAC Solutions

UNIT - V
**Mobile and MSA**: Mobile Technologies, Types of Mobile Applications, MSA for mobile solutions

Case Study: SOA – Loan Management System (LMS) PoC, MSA – APIary PoC

**Textbook:**
M.Tech CFIS II Semester

SYSTEMS AND NETWORK SECURITY LAB

Objectives
1. The main objective is to get knowledge in Configuring DNS Server, Detecting malicious codes and analysing networks through tools, implementing various Encryption algorithms.

Outcomes
1. Get the knowledge in detection, protection of Intrusions, malicious codes.
2. To get awareness on DNS server, webcrawler, encryption the level of security required for a system in Intranet, Internet, cellular networks.

List of Experiments
1. Write a procedure to Logon and Logoff to Linux in both Text mode and graphical mode.
2. Configure a DNS Server with a domain name of your choice.
3. Configure FTP on Linux Server. Transfer files to demonstrate the working of the same.
4. Detection of Malicious Code in Registry and Task Manager.
5. Checking for rootkits existence in windows.
7. Techniques to stop web crawler.
8. Sniff the network traffic while performing port scanning using Nmap.
9. Perform port scanning on Metasploitable 2 vulnerable VM.
10. Install JCrypt tool (or any other equivalent) and demonstrate Asymmetric, Symmetric crypto algorithm, Hash and Digital/PKI signatures studied in theory Network Security and Management.

11. Write a client-server program where client sends a text message to server and server sends the text message to client by changing the case (uppercase and lowercase) of each character in the message.

12. Write a client-server program to implement following classical encryption techniques:
   (I) Caesar cipher
   (II) Transposition cipher
   (III) Row substitution cipher
   (IV) Hill cipher

Text Books
M.Tech CFIS II Semester

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CYBER CRIME INVESTIGATION & DIGITAL FORENSICS LAB

Objectives
1. To provide students with a comprehensive overview of collecting, investigating, preserving, and presenting evidence of cyber crime left in digital storage devices, emails, browsers, mobile devices using different Forensics tools
2. To Understand file system basics and where hidden files may lie on the disk, as well as how to extract the data and preserve it for analysis.
3. Understand some of the tools of e-discovery.
4. To understand the network analysis, Registry analysis and analyse attacks using different forensics tools

Outcomes
1. Learn the importance of a systematic procedure for investigation of data found on digital storage media that might provide evidence of wrong-doing
2. To Learn the file system storage mechanisms and retrieve files in hidden format
3. Learn the use of computer forensics tools used in data analysis.
4. Learn how to find data that may be clear or hidden on a computer disk, find our the open ports for the attackers through network analysis, Registry analysis.

Experiments
1. Perform email analysis using the tools like Exchange EDB viewer, MBOX viewer and View user mailboxes and public folders, Filter the mailbox data based on various criteria, Search for particular items in user mailboxes and public folders
2. Perform Browser history analysis and get the downloaded content, history, saved logins, searches, websites visited etc using Foxton Forensics tool, Dumpzilla.
3. Perform mobile analysis in the form of retrieving call logs, SMS log, all contacts list using the forensics tool like SAFT
4. Perform Registry analysis and get boottime logging using process monitor tool
5. Perform Disk imaging and cloning the using the X-way Forensics tools
6. Perform Data Analysis i.e History about open file and folder, and view folder actions using Lastview activity tool
7. Perform Network analysis using the Network Miner tool.
8. Perform information for incident response using the crowd Response tool
9. Perform File type detection using Autospy tool
10. Perform Memory capture and analysis using the Live RAM capture or any forensic tool

Textbooks
M.Tech CFIS II Semester

DATA ANALYTICS FOR FRAUD DETECTION LAB

Objective
1. The main objective is to perform data analysis and detect fraud activities

Outcome
1. Gain knowledge in performing fraud detection by data analysis using different tools

List Of Experiments
1. Perform data analysis i.e history about open file and folder, and view folder actions using last view activity tool
2. Perform file type detection using auto spy tool
3. Perform network analysis using the network miner tool
4. Create a social networking website login page using phishing techniques
5. Analyse ddos attacks and write code to prevent ddos attacks
6. Analyse sql injection attacks and write code to prevent ddos attacks
7. Analyse buffer overflow attacks and write code to prevent ddos attacks
8. Perform memory capture and analysis using the live ram capture or any forensic tool

Text Books
1. Fraud and Fraud Detection: A Data Analytics Approach by Sunder Gee, Wiley
M.Tech CFIS II Semester

DIGITAL WATERMARKING AND STEGANOGRAPHY LAB

Objective
1. To provide knowledge in implementing watermarking and steganography lab

Outcomes
1. To implement watermarking techniques and Steganography techniques using code

List of Experiments
1. Write a code to implement watermarking in the document.
2. Write a code to remove watermarking from the document
3. Write a code to hide the data in image
4. Write a code to hide the photo in plain sight
5. Write a code to hide to implement Information hiding
6. Implement the Hiding the text in image using stegnography S-Tool
7. Write a code to retrieve the hidden image from data
8. Write a code to retrieve the hidden text from image
9. Write a code to extract photo from plainsight
10. Write a code to implement encryption using stegnography

Textbooks:
SOA & MICRO-SERVICES LAB

Prerequisites

1. A Course on “OOPS through JAVA”

Objectives:

1. To learn how to implement and deploy web service client and server.

Outcomes

1. Students will be able to learn webservices, SOA Principles

List of Programs:

1. Write a program to implement a) Web based service consumer b) Windows application based web service.
2. Develop at least 5 components such as Order Processing, Payment Processing, etc., using .NET component technology.
3. Develop at least 5 components such as Order Processing, Payment Processing, etc., using EJB component technology
4. Develop a Service Orchestration Engine (workflow) using WS-BPEL and implement service composition. For example, a business process for planning business travels will invoke several services. This process will invoke several airline companies (such as American Airlines, Delta Airlines etc.) to check the airfare price and buy at the lowest price.
5. Develop a J2EE client to access a .NET web services
6. Build a microservice to track vehicle information.

Textbooks:

2. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India.
3. Developing Enterprise Web Services, S. Chatterjee, J. Webber, Pearson Education.

References:

1. XML, Web Services, and the Data Revolution, F.P. Coyle, Pearson Education.
3. Java Web Services, D.A. Chappell & T. Jewell, O’Reilly, SPD.
M.Tech CFIS III Semester

ADHOC AND SENSOR NETWORKS
(Program Elective - V)

Prerequisites
1. A course on “Computer Networks”
2. A course on “Mobile Computing”

Objectives
1. To understand the concepts of sensor networks
2. To understand the MAC and transport protocols for ad hoc networks
3. To understand the security of sensor networks
4. To understand the applications of adhoc and sensor networks

Outcomes
1. Ability to understand the state of the art research in the emerging subject of Ad Hoc and Wireless Sensor Networks
2. Ability to solve the issues in real-time application development based on ASN.
3. Ability to conduct further research in the domain of ASN

UNIT - I
Introduction to Ad Hoc Networks
Characteristics of MANETs, Applications of MANETs and Challenges of MANETs.

Routing in MANETs
Criteria for classification, Taxonomy of MANET routing algorithms, Topology-based routing algorithms-**Proactive**: DSDV; **Reactive**: DSR, AODV; Hybrid: ZRP; Position-based routing algorithms-**Location Services**: DREAM, Quorum-based; **Forwarding Strategies**: Greedy Packet, Restricted Directional Flooding-DREAM, LAR.

UNIT - II
Data Transmission
Broadcast Storm Problem, **Rebroadcasting Schemes**: Simple-flooding, Probability-based Methods, Area-based Methods, Neighbor Knowledge-based: SBA, Multipoint Relaying, AHBP. **Multicasting**: **Tree-based**: AMRIS, MAODV; **Mesh-based**: ODMRP, CAMP; **Hybrid**: AMRoute, MCEDAR.

UNIT - III
Geocasting
Data-transmission Oriented-LBM; Route Creation Oriented-GeoTORA, MGR. TCP over Ad Hoc TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc

UNIT - IV
Basics of Wireless, Sensors and Lower Layer Issues
Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer, Routing Layer.

UNIT - V
Upper Layer Issues of WSN
Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs, Sensor Networks and mobile robots.
Textbooks:
M.Tech CFIS III Semester

CYBER LAWS AND SECURITY POLICIES
(Program Elective - V)

Objectives
1. To understand the computer security issues
2. To make secure system planning, policies

Outcomes
1. Describe laws governing cyberspace and analyze the role of Internet Governance in framing policies for Internet security
2. the importance of ethics in legal profession and determine the appropriate ethical and legal behaviour according to legal frameworks

UNIT - I

UNIT - II

UNIT - III
Information security policies and procedures: Corporate policies- Tier 1, Tier 2 and Tier3 policies - process management-planning and preparation-developing policies-asset classification policy-developing standards.

UNIT - IV
Information security: fundamentals-Employee responsibilities- information classification- Information handling- Tools of information security- Information processing-secure program administration.

UNIT - V

References:
M.Tech CFIS III Semester  

INTERNET OF THINGS  
(Program Elective - V)  

Objectives  
1. Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to design & develop IOT Devices.

Outcomes  
1. Able to understand the application areas of IOT  
2. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks  
3. Able to understand building blocks of Internet of Things and characteristics.

UNIT - I  

UNIT - II  
IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT. Basics of IoT System Management with NETCOZF, YANG-NETCONF, YANG, SNMP NETOPEER

UNIT - III  
Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling. Python packages - JSON, XML, HTTP Lib, URL Lib, SMTP Lib.

UNIT - IV  

UNIT - V  
IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs. Webserver – Web server for IoT, Cloud for IoT, Python web application framework. Designing a RESTful web API

Textbooks:  
M.Tech CFIS III Semester

SOCIAL, WEB AND MOBILE ANALYTICS
(Program Elective - V)

Objective
1. Students must demonstrate knowledge of collecting and managing the relevant data of web and Social media analytics, identify the social business analytics and analyzing mobile data analytics with respect to publishers, operators and e-mail marketing.

Outcomes:
1. Understand the basic concepts of Web and Social Analytics.
2. Explain the process of collecting relevant data.
3. Identify the common business objectives.
4. Understand the concepts of mobile analytics.
5. Explain the concepts of mobile customer experience.
6. Analyze the mobile analytics for publisher, operator and email marketing.

UNIT- I

UNIT - II
The Awesome World of Click Stream Analysis: Metrics, Standard Metrics Revisited: Eight Critical Web Metrics, Visits and Visitors, Time on Page and Time on Site, Bounce Rate, Exit Rate, Conversion Rate, Engagement, Web Metrics Demystified, Four Attributes of Great Metrics, Example of a Great Web Metric, Strategically-aligned Tactics for Impactful Web Metrics, Diagnosing the Root Cause of a Metric's Performance—Conversion, Leveraging Custom Reporting, Starting with Macro Insights

UNIT - III
The Key to Glory: Measuring Success: Focus on the “Critical Few”, Five Examples of Actionable Outcome KPIs, Task Completion Rate, Share of Search, Visitor Loyalty and Recency, RSS/Feed Subscribers, % of Valuable Exits, Moving Beyond Conversion Rates, Cart and Checkout Abandonment, Days and Visits to Purchase, Average Order Value, Primary Purpose (Identify the Convertible), Measuring Macro and Micro Conversions, Examples of Macro and Micro Conversions, Quantifying Economic Value, Measuring Success for a Non-ecommerce Website, Visitor Loyalty, Visitor Recency, Length of Visit, Depth of Visit, Measuring B2B Websites.

UNIT-IV
Emerging Analytics: Social, Mobile, and Video: Measuring the New Social Web: The Data Challenge, The Content Democracy Evolution, The Twitter Revolution, Analyzing Offline Customer Experiences (Applications), Analyzing Mobile Customer Experiences, Mobile Data Collection: Options, Mobile Reporting and Analysis, Measuring the Success of Blogs, Raw Author Contribution, Holistic Audience Growth, Citations and Ripple Index, Cost of Blogging, Benefit (ROI) from Blogging, Quantifying the Impact of Twitter, Growth in Number of Followers, Message Amplification, Click-Through Rates and Conversions,
UNIT-V
Mobile Analytics: How Mobile Is Different than Other Digital Channels

Textbooks:
1. Stanley Wasserman, Katherine Faust, “Social Network Analysis: Methods And Applications” Cambridge University Press. (Chapter -1)

References:
1. Social, Web and Mobile Analytics (IBM ICE Publication)
M.Tech CFIS III Semester

INFORMATION SECURITY
(Open Elective)

Prerequisites
1. A Course on “Computer Networks”
2. A Course on “Mathematics”

Objectives
1. To understand the fundamentals of Cryptography
2. To understand various key distribution and management schemes
3. To understand how to deploy encryption techniques to secure data in transit across data networks
4. To apply algorithms used for secure transactions in real world applications

Outcomes
1. Demonstrate the knowledge of cryptography, network security concepts and applications.
2. Ability to apply security principles in system design.
3. Ability to identify and investigate vulnerabilities and security threats and mechanisms to counter them.

UNIT-I
Security Attacks
( Interruption, Interception, Modification and Fabrication),

Security Services
(Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security.

UNIT-II
Public key Cryptography
Message authentication and Hash Functions, Authentication Requirements and Functions, Message Authentication, Hash Functions and MACs Hash and MAC Algorithms SHA-512, HMAC.

UNIT -III
Digital Signatures
Email Security: Pretty Good Privacy (PGP) and S/MIME.

UNIT-IV
IP Security
Web Security
Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).

UNIT-V

Textbook:

References:
M.Tech CFIS III Semester

ETHICAL HACKING
(Open Elective)

Prerequisites
1. A course on “Operating Systems”
2. A course on “Computer Networks”
3. A course on “Network Security and Cryptography”

Objectives
1. The aim of the course is to introduce the methodologies and framework of ethical hacking for enhancing the security.
2. The course includes-Impacts of Hacking; Types of Hackers; Information Security Models; Information Security Program; Business Perspective; Planning a Controlled Attack; Framework of Steps (Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Deliverable and Integration)

Outcomes
1. Gain the knowledge of the use and availability of tools to support an ethical hack
2. Gain the knowledge of interpreting the results of a controlled attack
3. Understand the role of politics, inherent and imposed limitations and metrics for planning of a test
4. Comprehend the dangers associated with penetration testing

UNIT- I
Introduction
Hacking Impacts, The Hacker

Framework
Planning the test, Sound Operations, Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Final Analysis, Deliverable, Integration

Information Security Models

Information Security Program
The Process of Information Security, Component Parts of Information Security Program, Risk Analysis and Ethical Hacking

UNIT - II
The Business Perspective
Business Objectives, Security Policy, Previous Test Results, Business Challenges

Planning for a Controlled Attack
Inherent Limitations, Imposed Limitations, Timing is Everything, Attack Type, Source Point, Required Knowledge, Multi-Phased Attacks, Teaming and Attack Structure, Engagement Planner, The Right Security Consultant, The Tester, Logistics, Intermediates, Law Enforcement

UNIT - III
Preparing for a Hack
Technical Preparation, Managing the Engagement

Reconnaissance
Social Engineering, Physical Security, Internet Reconnaissance
UNIT - IV
Enumeration
Enumeration Techniques, Soft Objective, Looking Around or Attack, Elements of Enumeration, Preparing for the Next Phase
Exploitation
Intuitive Testing, Evasion, Threads and Groups, Operating Systems, Password Crackers, RootKits, applications, Wardialing, Network, Services and Areas of Concern

UNIT - V
Deliverable
The Deliverable, The Document, Overal Structure, Aligning Findings, Presentation
Integration
Integrating the Results, Integration Summary, Mitigation, Defense Planning, Incident Management, Security Policy, Conclusion

Textbook:

References:
1. Ethical Hacking and Countermeasures Attack Phases, EC-Council, Cengage Learning
VALUE EDUCATION
(Audit Course - I)

Objectives
Students will be able to
1. Understand value of education and self-development
2. Imbibe good values in students
3. Let the should know about the importance of character

Outcomes
Students will be able to
1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality

UNIT – I

UNIT – II

UNIT - III

UNIT – IV

Textbook:
ENGLISH FOR RESEARCH PAPER WRITING
(Audit Course - II)

Objectives:
Students will be able to:
1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title
4. Ensure the good quality of paper at very first-time submission

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

UNIT - II

UNIT - III
Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT - IV
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,

UNIT - V
Skills are needed when writing the Methods, Skills needed when writing the Results, Skills are needed when writing the Discussion, Skills are needed when writing the Conclusions

UNIT - VI
Useful phrases, how to ensure paper is as good as it could possibly be the first – time submission

Suggested Studies: