JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech. COMPUTER NETWORKS AND INFORMATION SECURITY/COMPUTER NETWORKS/CYBER SECURITY

EFFECTIVE FROM ACADEMIC YEAR 2019 - 20 ADMITTED BATCH

COURSE STRUCTURE AND SYLLABUS

I YEAR I – SEMESTER

<table>
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*For Dissertation Work Review - I, Please refer 7.8 in R19 Academic Regulations.

### Audit Course I & II:
1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by yoga
8. Personality Development Through Life Enlightenment Skills
DISTRIBUTED SYSTEMS (PC– I)

Prerequisites:
- A course on “Operating Systems”.

Course Objectives:
- This course provides an insight into Distributed systems.
- Topics include- Peer to Peer Systems, Transactions and Concurrency control, Security and Distributed shared memory

Course Outcomes:
- Ability to understand Transactions and Concurrency control.
- Ability to understand Security issues.
- Understanding Distributed shared memory.

UNIT - I
Characterization of Distributed Systems-Introduction, Examples of Distributed systems, Resource sharing and web, challenges, System models-Introduction, Architectural and Fundamental models, Networking and Internetworking, Interprocess Communication, Distributed objects and Remote Invocation-Introduction, Communication between distributed objects, RPC, Events and notifications, Case study-Java RMI.

UNIT - II
Name Services-Introduction; Name Services and the Domain Name System, Case study of the Global Name Service, Case study of the X.500 Directory Service.

UNIT - III
Peer to Peer Systems–Introduction, Napster and its legacy, Peer to Peer middleware, Routing overlays, Overlay case studies-Pastry, Tapestry, Application case studies-Squirrel, OceanStore.
Time and Global States-Introduction, Clocks, events and Process states, Synchronizing physical clocks, logical time and logical clocks, global states, distributed debugging.
Coordination and Agreement-Introduction, Distributed mutual exclusion, Elections, Multicast communication, consensus and related problems.

UNIT - IV
Transactions and Concurrency control-Introduction, Transactions, Nested Transactions, Locks, Optimistic concurrency control, Timestamp ordering, Comparison of methods for concurrency control.
Distributed Transactions-Introduction, Flat and Nested Distributed Transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery, Replication-Introduction, System model and group communication, Fault tolerant services, Transactions with replicated data.

UNIT - V
Security-Introduction, Overview of Security techniques, Cryptographic algorithms, Digital signatures, Case studies-Kerberos, TLS, 802.11 WiFi.
Distributed shared memory, Design and Implementation issues, Sequential consistency and Ivy case study, Release consistency and Munin case study, Other consistency models, CORBA case study-Introduction, CORBA RMI, CORBA Services.

**Text Books:**

**Reference Books:**
ADVANCED DATA STRUCTURES (PC– II)

Pre-Requisites: UG level course in Data Structures

Course Objectives:
- The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
- Students should be able to understand the necessary mathematical abstraction to solve problems.
- To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
- Student should be able to come up with analysis of efficiency and proofs of correctness.

Course Outcomes: After completion of course, students would be able to:
- Understand the implementation of symbol table using hashing techniques.
- Understand the implementation of symbol table using hashing techniques.
- Develop algorithms for text processing applications.
- Identify suitable data structures and develop algorithms for computational geometry problems.

UNIT - I
Dictionaries:
Definition, Dictionary, Abstract Data Type, Implementation of Dictionaries.

Hashing:

UNIT - II
Skip Lists:

UNIT - III
Trees:

UNIT - IV
Text Processing:

UNIT - V
Computational Geometry:
One Dimensional Range Searching, Two-Dimensional Range Searching, constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadtrees, k-D Trees.
Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem
References:
INFORMATION SECURITY (Professional Elective - I)

Prerequisites
1. A Course on “Computer Networks and a course on Mathematics

Course 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

Course 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
Message authentication and Hash Functions, Authentication Requirements and Functions, Message Authentication, Hash Functions and MACs Hash and MAC Algorithms SHA-512, HMAC.

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

UNIT - IV
IP Security:

UNIT - V
Text Book:

Reference Books:
Course Objectives:
1. Learn the fundamentals of network coding theory.
2. Understand the performance parameters required for network coding.
3. Gain the knowledge of the network coding design methods.
4. Learn different approaches for the network coding.
5. Understand error correction and detection methods of adversarial errors.

Course Outcomes:
1. Demonstrate knowledge and understanding of the fundamentals of Network Coding Theory.
2. Summarize all the performance parameters and resources for network coding.
3. Construct the network code for different networks.
4. Deal with different approaches of Network Coding in lossy and lossless networks.
5. Deal with multiple sources network coding and detect adversarial errors.

UNIT - I
Main Theorem of Network Multicast: The Min-Cut Max-flow Theorem, The Main network coding Theorem.

UNIT - II
Networks with Delay and Cycles: Dealing with Delay, Optimizing for Delay, Dealing with Cycles.
Resources for Network Coding: Bounds on Code Alphabet Size, Bounds on the Number of Coding Points, Coding with Limited Resources.

UNIT - III
Network Code Design Methods For Multicasting: Common initial procedure, centralized algorithms, decentralized algorithms, scalability to network changes.
Single-Source Linear Network Coding:
Acyclic Networks: Acyclic Networks, Linear network code, Desirable properties of a linear network code, Existence and construction, Algorithm refinement for multicast.
Cyclic Networks: Delay-Free Cyclic Code, Non-equivalence between local and global descriptions, Convolutional network code, decoding of convolutional network code.

UNIT - IV
Network Coding in Lossy Networks: Random linear network coding, Coding theorems: Unicast connections, Multicast connections, Error exponents for Poisson traffic with i.i.d. losses.

UNIT - V
Multiple Sources Network Coding:
Superposition coding and max-flow bound; Network Codes for Acyclic Networks: Achievable information rate region, Inner bound $R_{in}$, Outer bound $R_{out}$, $R_{LP}$ – An explicit outer bound.


Text Books:

Reference Books:
Prerequisites: A Course on “Computer Networks, Mathematics”.

Course Objectives:
- To understand the importance of cryptanalysis in our increasingly computer-driven world.
- To understand the fundamentals of Cryptography
- To understand the Lattice-based cryptanalysis and elliptic curves and pairings
- To understand birthday-based algorithms for functions and attacks on stream ciphers
- To apply the techniques for secure transactions in real world applications

Course Outcomes:
- Ability to apply cryptanalysis in system design to protect it from various attacks.
- Ability to identify and investigate vulnerabilities and security threats and the mechanisms to counter them.
- Ability to analyze security of cryptographic algorithm against brute force attacks, birthday attacks.

UNIT - I
A bird’s eye view of modern Cryptography: Preliminaries, Defining Security in Cryptography
Monoalphabetic Ciphers: Using Direct Standard Alphabets, The Caesar Cipher, Modular arithmetic, Direct Standard alphabets, Solution of direct standard alphabets by completing the plain component, Solving direct standard alphabets by frequency considerations, Alphabets based on decimations of the normal sequence, Solution of decimated standard alphabets, Monoalphabets based on linear transformation.

Polyalphabetic Substitution: Polyalphabetic ciphers, Recognition of polyalphabetic ciphers, Determination of number of alphabets, Solution of individual alphabets if standard, Polyalphabetic ciphers with a mixed plain sequence, Matching alphabets, Reduction of a polyalphabetic cipher to a monoalphabetic cipher with mixed cipher sequences

UNIT - II
Transposition: Columnar transposition, Solution of transpositions with Completely filled rectangles, Incompletely filled rectangles, Solution of incompletely filled rectangles – Probable word method, Incompletely filled rectangles general case, Repetitions between messages; identical length messages.
Sieve algorithms: Introductory example: Eratosthenes’s sieve, Sieving for smooth composites

UNIT - III
Brute force Cryptanalysis: Introductory example: Dictionary attacks, Brute force and the DES Algorithm, Brute force as a security mechanism, Brute force steps in advanced cryptanalysis, Brute force and parallel computers.

The birthday paradox: Sorting or not?: Introductory example: Birthday attacks on modes of operation, Analysis of birthday paradox bounds, Finding collisions, Application to discrete logarithms in generic groups.

UNIT - IV
Birthday-based algorithms for functions: Algorithmic aspects, Analysis of random functions, Number-theoretic applications, A direct cryptographic application in the context of blockwise security, Collisions in hash functions.

Attacks on stream ciphers: LFSR-based key stream generators,
Correlation attacks, Noisy LFSR model, Algebraic attacks, Extension to some non-linear shift registers, The cube attack.

UNIT - V

Text Books:
2. Algorithmic Cryptanalysis” by Antoine joux, CRC Press’

References:
2. Cryptanalysis of Number Theoretic Ciphers, Sameul S. Wag staff, Champan & Hall/CRC.
NETWORK SECURITY (Professional Elective - II)

Pre-Requisites: Computer Networks, Web Programming

Course Objectives:
- To learn the basics of security and various types of security issues.
- To study different cryptography techniques available and various security attacks.
- Explore network security and how they are implemented in real world.
- To get an insight of various issues of Web security and biometric authentication.

Course Outcomes: After completion of course, students would be able to:
- To understand basics of security and issues related to it.
- Understanding of biometric techniques available and how they are used in today's world.
- Security issues in web and how to tackle them.
- Learn mechanisms for transport and network security.

UNIT – I
Data security: Review of cryptography. Examples RSA, DES, ECC.

UNIT – II

UNIT - III
Network security: Firewalls, Proxy-Servers, Network intrusion detection.
Transport security: Mechanisms of TLS, SSL, IPSec.

UNIT - IV
Web security – SQL injection, XSS, etc. Software security and buffer overflow. Malware types and case studies. Access Control, firewalls and host/network intrusion detection.

UNIT - V
Other topics: Biometric authentication, Secure E-Commerce (ex. SET), Smart Cards, Security in Wireless Communication. Recent trends in IOT security, IDS and Biometric.

References:
ADVANCED WIRELESS NETWORKS (Professional Elective - II)

Pre-Requisites: Computer Networks

Course Objectives:

- The students should get familiar with the wireless/mobile market and the future needs and challenges.
- To get familiar with key concepts of wireless networks, standards, technologies and their basic Operations.
- To learn how to design and analyse various medium access.
- To learn how to evaluate MAC and network protocols using network simulation software tools.
- The students should get familiar with the wireless/mobile market and the future needs and challenges.

Course Outcomes: After completion of course, students would be able to:

- Demonstrate advanced knowledge of networking and wireless networking and understand various types of wireless networks, standards, operations and use cases.
- Be able to design WLAN, WPAN, WWAN, Cellular based upon underlying propagation and performance analysis.
- Demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks.
- Design wireless networks exploring trade-offs between wire line and wireless links.
- Develop mobile applications to solve some of the real-world problems.

UNIT - I
Introduction:

Wireless Local Area Networks:
IEEE 802.11 Wireless LANs Physical & MAC layer, 802.11 MAC Modes (DCF & PCF) IEEE 802.11 standards, Architecture & protocols, Infrastructure vs. Adhoc Modes, Hidden Node & Exposed Terminal Problem, Problems, Fading Effects in Indoor and outdoor WLANs, WLAN Deployment issues

UNIT – II
Wireless Cellular Networks:

UNIT - III
WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE802.22 Wireless Regional Area Networks, IEEE 802.21 Media Independent Handover Overview

Wireless Sensor Networks:
Introduction, Application, Physical, MAC layer and Network Layer, Power Management, Tiny OS Overview.
UNIT - IV
Wireless PANs:

UNIT - V
Security:

Advanced Topics
IEEE 802.11x and IEEE 802.11i standards, Introduction to Vehicular Adhoc Networks

References:
1. Schiller J., Mobile Communications, Addison Wesley 2000
2. Stallings W., Wireless Communications and Networks, Pearson Education 2005
5. Pandya Raj, Mobile and Personal Communications Systems and Services, PHI 200
TRUSTWORTHY COMPUTING (Professional Elective - II)

**Prerequisites:** An introductory course in Computer Networks

**Course Objectives:** The main objectives of the proposed course are:
- To make students realize the practical risks and concerns in network security
- To introduce a coherent framework for understanding network security
- To introduce the field’s essential security concepts and techniques used to secure a network
- To expose the students to new state-of-the-art research topics in network security

**Course Outcomes:**
- Demonstrate the knowledge of cryptography, network security concepts and applications.
- Ability to apply security principles in system design.
- Ability to identify and investigate vulnerabilities and security threats and mechanisms to counter them.

**UNIT - I**

**Symmetric Encryption and Message Confidentiality:** Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Random and Pseudorandom Numbers, Stream Ciphers and RC4, Cipher Block Modes of Operation

**UNIT - II**
**Public-Key Cryptography and Message Authentication:**

**UNIT - III**
**Key Distribution and User Authentication:**
Symmetric Key Distribution Using Symmetric Encryption, Kerberos, Key Distribution Using Asymmetric Encryption, X.509 Certificates, Public-Key Infrastructure.

**UNIT - IV**
**Electronic Mail Security:** Pretty Good Privacy, S/MIME, Domain Keys Identified Mail.
**IP Security:**

**UNIT - V**
**Intruders:**
Intruders, Intrusion Detection, Password Management

**Malicious Software:**
Types of Malicious Software, Viruses, Virus Countermeasures, Worms, Distributed Denial of Service Attacks

**Firewalls:**
The Need for Firewalls, Firewall Characteristics, Types of Firewalls, Firewall Basing, Firewall Location and Configurations
Text Book:
ADVANCED DATA STRUCTURES LAB (Lab - I)

Prerequisites: A course on Computer Programming & Data Structures

Course 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.

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

TEXT BOOKS:

REFERENCES:
1. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/Pearson Education
INFORMATION SECURITY LAB (Lab – II)

Course Objectives:
- To implement the cryptographic algorithms.
- To implement the security algorithms.
- To implement cryptographic, digital signatures algorithms.

List of Experiments:
1. Implementation of symmetric cipher algorithm (AES and RC4)
2. Random number generation using a subset of digits and alphabets.
3. Implementation of RSA based signature system
4. Implementation of Subset sum
5. Authenticating the given signature using MD5 hash algorithm.
6. Implementation of Diffie-Hellman algorithm
7. Implementation ElGAMAL cryptosystem.
8. Implementation of Goldwasser-Micali probabilistic public key system
10. Implementation of Kerberos cryptosystem
11. Firewall implementation and testing.
12. Implementation of a trusted secure web transaction.
13. Cryptographic Libraries-Sun JCE/Open SSL/Bouncy Castle JCE.
14. Digital Certificates and Hybrid (ASSY/SY) encryption, PKI.
15. Message Authentication Codes.
16. Elliptic Curve cryptosystems (Optional)
17. PKCS Standards (PKCS1, 5, 11, 12), Cipher modes.
RESEARCH METHODOLOGY & IPR

Prerequisite: None

Course Objectives:
- To understand the research problem
- To know the literature studies, plagiarism and ethics
- To get the knowledge about technical writing
- To analyze the nature of intellectual property rights and new developments
- To know the patent rights

Course Outcomes: At the end of this course, students will be able to
- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today’s world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT-I:
Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT-II:
Effective literature studies approaches, analysis, Plagiarism, Research ethics

UNIT-III:
Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT-IV:

UNIT-V:
TEXT BOOKS:
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”

REFERENCES:
Pre-Requisites: UG level course in Algorithm Design and Analysis

Course Objectives:
- Introduce students to the advanced methods of designing and analyzing algorithms.
- The student should be able to choose appropriate algorithms and use it for a specific problem.
- To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
- Students should be able to understand different classes of problems concerning their computation difficulties.
- To introduce the students to recent developments in the area of algorithmic design.

Course Outcomes: After completion of course, students would be able to:
- Analyze the complexity/performance of different algorithms.
- Determine the appropriate data structure for solving a particular set of problems.
- Categorize the different problems in various classes according to their complexity.
- Students should have an insight of recent activities in the field of the advanced data structure.

UNIT – I
Sorting:
Review of various sorting algorithms, topological sorting

Graph:
Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

UNIT – II
Matroids:
Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST.

Graph Matching:
Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.

UNIT - III
Flow-Networks:
Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.

Matrix Computations:
Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.

UNIT - IV
Shortest Path in Graphs:
Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming.
Modulo Representation of integers/polynomials:

Discrete Fourier Transform (DFT):

UNIT - V

Linear Programming:
Geometry of the feasibility region and Simplex algorithm

NP-completeness:
Examples, proof of NP-hardness and NP-completeness.

One or more of the following topics based on time and interest:
Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm
Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

References:
1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
WEB AND DATABASE SECURITY (PC – IV)

Pre-Requisites: Database Management

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

Course 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
Concepts and Techniques, Database Watermarking for Copyright Protection, Trustworthy Records Retention, Damage Quarantine and Recovery in Data Processing Systems, Hippocratic Databases: Current Capabilities and

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 G. Arlinkel, Gene Spafford, O’ Reilly,
2. Handbook on Database security applications and trends, Michael Gertz, Sushil Jajodia.
Course Objectives:
- To understand about the intruders.
- To know the intrusion detection and prevention policies

UNIT- I

THEORETICAL FOUNDATIONS OF DETECTION:
- Taxonomy of anomaly detection system
- Fuzzy logic
- Bayes theory
- Artificial Neural networks
- Support vector machine
- Evolutionary computation
- Association rules
- Clustering

UNIT- II
Architecture and Implementation: Centralized – Distributed – Cooperative Intrusion Detection - Tiered architecture

UNIT- III
Justifying Intrusion Detection: Intrusion detection in security – Threat Briefing – Quantifying risk – Return on Investment (ROI)

UNIT- IV

UNIT- V

References:
INTERNET OF THINGS (Professional Elective - III)

Course Objectives:
- To introduce the terminology, technology and its applications
- To introduce the concept of M2M (machine to machine) with necessary protocols
- To introduce the Python Scripting Language which is used in many IoT devices
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of web-based services on IoT devices

UNIT - I
Introduction to Internet of Things – Definition and Characteristics of IoT,
Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs
IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics,
Communication protocols, Embedded Systems, IoT Levels and Templates
Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry,
health and Lifestyle

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, HTTPLib, URLLib, SMTPLib

UNIT - IV
IoT Physical Devices and Endpoints - Introduction to Raspberry Pi-Interfaces (serial, SPI, I2C)
Programming – Python program with Raspberry PI with focus of interfacing external gadgets,
controlling output, reading input from pins.

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

Text Books:
1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014,
Course Objectives:
- Understand the fundamentals of cloud computing.
- Understand the requirements for an application to be deployed in a cloud.
- Become knowledgeable in the methods to secure cloud.

UNIT – I

UNIT – II
Cloud Applications: Technologies and the processes required when deploying web services- Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages- Development environments for service development; Amazon, Azure, Google App.

UNIT – III
Securing The Cloud: Security Concepts - Confidentiality, privacy, integrity, authentication, nonrepudiation, availability, access control, defence in depth, least privilege- how these concepts apply in the cloud and their importance in PaaS, IaaS and SaaS. e.g. User authentication in the cloud.

UNIT - IV
Virtualization Security: Multi-tenancy Issues: Isolation of users/VMs from each other- How the cloud provider can provide this- Virtualization System Security Issues: e.g. ESX and ESXi Security, ESX file system security issues, backup and recovery- Virtualization System Vulnerabilities.

UNIT - V

References:
DIGITAL IMAGE PROCESSING (Professional Elective - IV)

Prerequisites:
1. Students are expected to have knowledge in linear signals and systems, Fourier Transform, basic linear algebra, basic probability theory and basic programming techniques; knowledge of Digital Signal Processing is desirable.
2. A course on “Computational Mathematics”
3. A course on “Computer Oriented Statistical Methods”

Course Objectives
1. Provide a theoretical and mathematical foundation of fundamental Digital Image Processing concepts.
2. The topics include image acquisition; sampling and quantization; preprocessing; enhancement; restoration; segmentation; and compression.

Course Outcomes
1. Demonstrate the knowledge of the basic concepts of two-dimensional signal acquisition, sampling, and quantization.
2. Demonstrate the knowledge of filtering techniques.
3. Demonstrate the knowledge of 2D transformation techniques.
4. Demonstrate the knowledge of image enhancement, segmentation, restoration and compression techniques.

UNIT - I

UNIT - II

UNIT - III

UNIT - IV
Image Segmentation Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region Oriented Segmentation.

UNIT - V

Text Book:
References:
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (CNIS/CN/Cyber Security) – I Year – II Semester
Common to CNIS, CN and Cyber Security

BLOCKCHAIN TECHNOLOGY (Professional Elective - IV)

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

Course Objective:
1. Introduce block chain technology and Cryptocurrency

Course Outcome:
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 Book:
1. Blockchain Blueprint for Economy by Melanie Swan

Reference:
Course Objectives:
- To learn the biometric technologies.
- To learn the computational methods involved in the biometric systems.
- To learn methods for evaluation of the reliability and quality of the biometric systems.

UNIT – I
Introduction & Handwritten Character Recognition

UNIT – II
Face Biometrics & Retina And Iris Biometrics

UNIT – III
Privacy Enhancement Using Biometrics & Biometric Cryptography And Multimodal Biometrics

UNIT – IV.
Watermarking Techniques & Biometrics: Scope and Future

UNIT – V
Image Enhancement Techniques & Biometrics Stands

Text Books:

References:
WEB AND DATABASE SECURITY LAB (Lab - III)

Pre-requisites: Database Management Systems, Practical exposure on Commercial Database Management Systems, Web Security,

Course Outcomes: At the end of the course the student will be able to:
- Design of access control methods for secure web & database application development
- Analyse and Classify the vulnerabilities in the Web and Database applications.
- Design & implementation various methods for web & database intrusion detection.
- Design and Implementation security audit methods.

List of Experiments:
1. Creation and manipulation of database using SQL scripts and graphical interfaces.
2. Implementing DAC: Implementation of database security policies using DAC in oracle 10g/SQL server
3. Implementing of MAC to ensure confidentiality and control information flow using either Oracle 10g or SQL server. This provides exposure to understand the concepts of MAC and Trojan hose
4. Implementation of Virtual Private Database using View using Oracle 10g or SQL server
5. Design a method to simulate the HTML injections and cross-site scripting (XSS) to exploit the attackers.
6. Determine HTML injection bugs and possible measures to prevent HTML injection exploits.
8. Implementation of Design methods to break authentication schemes
9. Implementation of methods for abusing Design Deficiencies against web sites
INTERNET OF THINGS LAB (Lab - IV)

Course Objectives:
1. To introduce the raspberry PI platform, that is widely used in IoT applications
2. To introduce the implementation of distance sensor on IoT devices

Course Outcomes
1. Ability to introduce the concept of M2M (machine to machine) with necessary protocols and get awareness in implementation of distance sensor
2. Get the skill to program using python scripting language which is used in many IoT devices

List of Experiments
1. Using raspberry pi
   a. Calculate the distance using distance sensor.
   b. Basic LED functionality.
2. Using Arduino
   a. Calculate the distance using distance sensor.
   b. Basic LED functionality.
   c. Calculate temperature using temperature sensor.
3. Using Node MCU
   a. Calculate the distance using distance sensor.
   b. Basic LED functionality.

Text Books:
DIGITAL FORENSICS (Professional Elective - V)

Pre-Requisites: Cybercrime and Information Warfare, Computer Networks

Course Objectives:
- Provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
- Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
- Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools
- E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics

Course Outcomes: On completion of the course the student should be able to
- Understand relevant legislation and codes of ethics.
- Computer forensics and digital detective and various processes, policies and procedures.
- E-discovery, guidelines and standards, E-evidence, tools and environment.
- Email and web forensics and network forensics.

UNIT - I
Digital Forensics Science: Forensics science, computer forensics, and digital forensics.
Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, holistic approach to cyber-forensics

UNIT - II
Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seize electronic evidence, retrieved and unretrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

UNIT - III
Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

UNIT - IV
Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case, Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.

UNIT - V
Mobile Forensics: mobile forensics techniques, mobile forensics tools.
Recent trends in mobile forensic technique and methods to search and seize electronic evidence
References:
SURVEILLANCE & VIDEO ANALYTICS (Professional Elective - V)

Course Outcomes:
- Understand the algorithms available for performing analysis on video data and address the challenges
- Understand the approaches for identifying and tracking objects and person with motion-based algorithms.
- Understand the algorithms available for searching and matching in video content
- Analyze approaches for action representation and recognition
- Identify, Analyze and apply algorithms for developing solutions for real world problems

UNIT - I
Introduction:

UNIT - II
Tracking & Video Analysis: Tracking and Motion Understanding – Kalman filters, condensation, particle, Bayesian filters, hidden Markov models, change detection and model-based tracking- Motion estimation and Compensation-Block Matching Method, Hierarchical Block Matching,

UNIT - III
Overlapped Block Motion and compensation, Pel-Recursive Motion Estimation, Mesh Based Method, Optical Flow Method - Motion Segmentation -Thresholding for Change Detection, Estimation of Model parameters - Optical Flow Segmentation-Modified Hough Transform Method

UNIT - IV
Segmentation for Layered Video Representation-Bayesian Segmentation - Simultaneous Estimation and Segmentation-Motion Field Model – Action Recognition - Low Level Image Processing for Action Recognition: Segmentation and Extraction, Local Binary Pattern, Structure from Motion

UNIT - V

Text Books/References:
DATA ANALYTICS FOR FRAUD DETECTION (Professional Elective - V)

Course 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.

Course 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.

Text Book:
1. Fraud and Fraud Detection: A Data Analytics Approach by Sunder Gee, Wiley.
Prerequisite: None

Course objectives: Students will be able to:
- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title 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. useful phrases, how to ensure paper is as good as it could possibly be the first-time submission

TEXT BOOKS/ REFERENCES:
Prerequisite: None

Course Objectives: Students will be able to
- learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- critically understand the strengths and weaknesses of disaster management approaches,
- planning and programming in different countries, particularly their home country or the countries they work in

UNIT-I:
Introduction:
Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

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

UNIT-II:
Repercussions of Disasters and Hazards:

UNIT-III:
Disaster Preparedness and Management:
Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT-IV:
Risk Assessment Disaster Risk:

UNIT-V:
Disaster Mitigation:
Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.
TEXT BOOKS/ REFERENCES:
Prerequisite: None

Course Objectives:
- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Course Outcomes: Students will be able to
- Understanding basic Sanskrit language
- Ancient Sanskrit literature about science & technology can be understood
- Being a logical language will help to develop logic in students

UNIT-I:
Alphabets in Sanskrit,

UNIT-II:
Past/Present/Future Tense, Simple Sentences

UNIT-III:
Order, Introduction of roots,

UNIT-IV:
Technical information about Sanskrit Literature

UNIT-V:
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

TEXT BOOKS/ REFERENCES:
1. “Abhyaspustakam” – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
VALUE EDUCATION (Audit Course - I & II)

Prerequisite: None

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

Course outcomes: Students will be able to
- Knowledge of self-development
- Learn the importance of Human values
- Developing the overall personality

UNIT-I:

UNIT-II:

UNIT-III:
Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness.

UNIT-IV:

UNIT-V:

TEXT BOOKS/ REFERENCES:
CONSTITUTION OF INDIA (Audit Course - I & II)

Prerequisite: None

Course Objectives: Students will be able to:
- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals’ constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

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

UNIT-I:

UNIT-II:

UNIT-III:
Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualification, Powers and Functions.

UNIT-IV:

UNIT-V:
TEXT BOOKS/ REFERENCES:
1. The Constitution of India, 1950 (Bare Act), Government Publication.
PEDAGOGY STUDIES (Audit Course - I & II)

Prerequisite: None

Course Objectives: Students will be able to:
- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DFID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Course Outcomes: Students will be able to understand:
- What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

UNIT-I:

UNIT-II:
Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT-III:
Evidence on the effectiveness of pedagogical practices, Methodology for the indepth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers’ attitudes and beliefs and Pedagogic strategies.

UNIT-IV:
Professional development: alignment with classroom practices and follow-up support. Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes

UNIT-V:
Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

TEXT BOOKS/REFERENCES:
STRESS MANAGEMENT BY YOGA (Audit Course - I & II)

Prerequisite: None

Course Objectives:
- To achieve overall health of body and mind
- To overcome stress

Course Outcomes: Students will be able to:
- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

UNIT-I:
Definitions of Eight parts of yog. (Ashtanga)

UNIT-II:
Yam and Niyam.

UNIT-III:
Do’s and Don’t’s in life.
i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT-IV:
Asan and Pranayam

UNIT-V:
i) Various yog poses and their benefits for mind & body
ii) Regularization of breathing techniques and its effects-Types of pranayam

TEXT BOOKS/ REFERENCES:
1. "Yogic Asanas for Group Tarining-Part-I": Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama
   (Publication Department), Kolkata
PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS
(Audit Course - I & II)

Prerequisite: None

Course Objectives:
- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Course Outcomes: Students will be able to
- Study of Shrimad-Bhagwat-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neetisatakam will help in developing versatile personality of students

UNIT-I:
Neetisatakam-Holistic development of personality
- Verses 19, 20, 21, 22 (wisdom)
- Verses 29, 31, 32 (pride & heroism)
- Verses 26, 28, 63, 65 (virtue)

UNIT-II:
Neetisatakam-Holistic development of personality
- Verses 52, 53, 59 (don'ts)
- Verses 71, 73, 75, 78 (do's)

UNIT-III:
Approach to day to day work and duties.
- Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47, 48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5, 13, 17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

UNIT-IV:
Statements of basic knowledge.
- Shrimad Bhagwad Geeta: Chapter 2-Verses 56, 62, 68
- Chapter 12-Verses 13, 14, 15, 16, 17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:

UNIT-V:
- Chapter 2-Verses 17, Chapter 3-Verses 36, 37, 42,
- Chapter 4-Verses 18, 38, 39
- Chapter 18 – Verses 37, 38, 63

TEXT BOOKS/ REFERENCES:
1. “Srimad Bhagavad Gita” by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari’s Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.