MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL701

Course Name : Cryptography

Credits : 3 L - 3 T - 0 P - 0

Course Type : Core

Prerequisites: None

Course Contents

Number theory: Prime numbers, GCD, Euclidean Algorithm, Extended Euclidean Algorithm, Fermat's theorem, Euler's theorem, Chinese remainder theorem, Discrete logarithms, Primality testing algorithms, Probability, Bays Theorem. Introduction to Information security and cryptography, Basic terminology and concepts, Classical Cryptographic techniques and their cryptanalysis, Shannon perfect secrecy, One Time Pad, Pseudo random generators, Semantic security, indistinguishability based Security. Stream ciphers and RC4, Various types of attacks, Chosen-Plaintext Attack. Chosen-Ciphertext Attack etc. Block Ciphers: Data Encryption Standard (DES), Advanced Encryption Standard (AES), DES attacks, Modes of operations One-way function, trapdoor one-way function, Public key cryptography, RSA cryptosystem, Diffie-Hellman key exchange algorithm, ElGamal Cryptosystem Cryptographic hash functions, secure hash algorithm, Message authentication, digital signature, RSA digital signature.

Recommended Readings

Text Books:-

1. William Stallings, Cryptography and Network Security: Principles and Practice, Prentice Hall

2. Douglas R. Stinson, Cryptography: Theory and Practice, Chapman and Hall

3. J. Katz and Y. Lindell, Introduction to Modern Cryptography, CRC press

4. N. Koblitz, Number Theory and Cryptography, Springer, 2001

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL703

Course Name : Advanced Data Structures and Algorithms

Credits : 3 L - 3 T - 0 P - 0

Course Type : Core

Prerequisites: None

Course Contents

RAM model – Notations, Recurrence analysis - Master's theorem and its proof - Amortized analysis, Recurrence equations. Advanced Data Structures: B-Trees, Binomial Heaps, Fibonacci Heaps, AVL trees, Red-black trees, B-trees, Splay trees, Interval trees; Disjoint set – union and path compression, Amortized analysis. Greedy Algorithms: shortest distance, minimum spanning tree, interval scheduling, interval partitioning; Divide and Conquer: sorting, integer and polynomial multiplication; Dynamic programming: Longest common subsequence. Chain of matrix multiplication, sequence alignment, Bellman Ford. Convex hull and Voronoi diagrams, line segments, Optimal polygon triangulation; Primality testing, Integer factorization; Graph algorithms: Matching and Flows; Parallel algorithms: Basic techniques for sorting, searching, merging. Intractability: Independent Set, Vertex Cover Randomized algorithms, Probabilistic algorithms. Approximate Algorithms: Vertex-cover, set-covering problems, Travelling Salesman problem. N Complexity classes - NP-Hard and NP-complete Problems - Cook's theorem NP completeness reductions, undecidability.

Recommended Readings

Text Books:-

1. Cormen, Leiserson, Rivest: Introduction to Algorithms, Prentice Hall of India.

2. AhoA.V , J.D Ulman: Design and analysis of Algorithms, Addison Wesley

3. Brassard : Fundamental of Algorithmics, PHI

4. Sara Baase: Computer Algorithms: Introduction to Design and Analysis, Pearson Education.

5. Papadimitriou, Steiglitz: Combinatorial Optimization: Algorithms and Complexity, PHI.

6. Motwani and Raghavan: Randomized Algorithms, Cambridge University Press

7. Vaizirani: Approximation Algorithms, Springer Verlag

8. Joseph Ja'Ja': Introduction to Parallel Algorithms, Addison-Wesley

9. Kleinberg, Tardos: Algorithm Design, Addison Wesley.

10. Dexter Kozen: The Design and Analysis of Algorithms. Springer, 1992.

11. SanjoyDasgupta, Christos Papadimitriou, and UmeshVazirani: Algorithms, McGraw Hill.

12. Robert Sedgewick and Kevin Wayne. Algorithms 4/e. Addison-Wesley.

13. Robert Tarjan: Data Structures and Network Algorithms, Society for Industrial and Applied Mathematics.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL705

Course Name : Computer and Network Security

Credits : 4 L - 3 T - 0 P - 2

Course Type : Core

Prerequisites: None

Course Contents

Introduction (a) Security(b) Malware(c) OWASP top ten and other major security issues in the world(d) CVE and other information(e) Introduce various type of security areas Software and OS Security: Common Bugs, Buffer Overflow, Runtime Defences against memory safety vulnerabilities, program verification and other vulnerabilities, Principles in OS Security; Mechanisms for confining bad code, Mechanisms for confining bad code : isolation, sandboxing, SFI and Virtualization, Trusted Computing Network and Web Security: Secure web site design (SQL injection, XSS, etc.), Browser Security, Security problems in network protocols: TCP/IP, DDoS Attacks, Network worms and bot-nets: attacks and defences, DNS and BGP security, Network defence tools – Firewall and Intrusion Detection. Future Networks Security: Introduction - The Security in Existing wireless Networks, Upcoming wireless networks and challenges, Thwarting and malicious behaviour – Naming and addressing, security association and secure neighbour discovery, secure routing in multichip wireless networks and privacy protection. Mobile OS Security and Privacy: Android, IOS security challenges, processor security, privacy, anonymity and censorship and other security issues according to the current situations and future requirements

Recommended Readings

Text Books:-

1. Security in Computing (3rd edition)

2. Research publications on security

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIP701

Course Name : Programming Lab 1

Credits : 2 L - 0 T - 1 P - 2

Course Type : Core

Prerequisites: Programming skills required

Course Contents

Programming exercises and experiments in Computer Networks and Security. a. Experiments on LAN Trainer Kit: Performance study of data link layer protocols, implementation and testing Network Layer routing protocols, understanding the steps involved in RC4 algorithm encryption b. Programming exercises using sockets c. Design and implementation of a Data Sniffer Programming exercises and experiments in Advanced Data Structures a. Primality testing b. Recursive algorithms c. Sorting algorithms d. Heaps, priority queues, and binary search trees e. Red-black trees f. Graph based algorithms g. String matching algorithms Programming on advanced data structures by choosing the right data representation formats based on the requirements of the problem and selecting the right algorithmic paradigm (such as greedy, dynamic programming, divide and conquer etc.). Implement the basic cryptographic algorithms: a. Euclidean and Extended Euclidean algorithm for finding the Greatest Common Divisor of two large integers. b. Chinese remainder theorem. c. Modular polynomial arithmetic d. Diffie-Hellman Key exchange protocol Implement the advanced cryptographic algorithms: Congruence of squares. Finding a congruence of squares modulo n to factor n. Construction of Finite Field of characteristic 2. Computations in elliptic curve over a finite field

Recommended Readings

Text Books:-

1. Menezes, P.C. van Oorschot, S.A. Vanstone: Handbook of Applied Cryptography: CRC Press, 1996.

2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, “Introduction to Algorithms (3rd Edition)”, T. Publisher: MIT Press.

3. Peter Brass, “Advanced Data Structures”, Cambridge University Press, 2008.

4. Abhijit Das and C.E.VeniMadhavan, Public-key Cryptography: Theory and Practice, Pearson, 2009.Bottom of Form

5. Introduction to Modern Cryptography, Jonathan Katz and Yehuda Lindell.

6. LAN Trainer user Manual

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CST904

Course Name : Research Methodology

Credits : 2 L - 2 T - 0 P - 0

Course Type : Core

Prerequisites: None

Course Contents

Unit I: Data Structures and Algorithms: Review of Data Structures, and most commonly used algorithms in Computer Science and Engineering – Sorting, DFS/BFS, and Pattern Searching. Unit II: Linear Algebra: Vectors - linear vector spaces, linear independence, norms and inner products, Basis and dimension, Matrices, Matrix operations, Inverse of a matrix Orthogonalization, Properties of determinants, Eigenvalues and eigenvectors, SVD and pseudo inverse, KL or hotelling transform. Unit III: Transforms Signals and representation, Convolution, Frequency Transforms, Properties of Fourier Transform, DFT, DCT and FFT, Introduction to wavelets, applications in Computer Science and Engineering Unit III: Probability and Statistics Statistics: Introduction to statistical analysis, hypothesis testing – null and alternate, statistical tests – chi-square, ANOVA, data validation Probability models and axioms, Bayes' rule, discrete and continuous random variables, Probability distributions: normal distribution and properties, conditional, marginal and joint probability distribution, PRNG (pseudo random number generators) - randomness tests, introduction to information theory and cryptography: an Introduction Unit IV: Machine Learning: Linear and non-linear regression, supervised learning – neural network, binary decision diagram, SVM, k-NN, unsupervised learning – Clustering, Hidden Markov Models, Introduction to deep learning. Unit V: Case Studies in Research Domains of CSE.

Recommended Readings

Text Books:-

1. Gilbert Strang: Linear Algebra, MIT Cambridge Press.

2. Sheldon Ross: First Course in Probability, Pearson.

3. Mark Girolami, Simon Rogers: First Course In Machine Learning, CRC Press.

4. Anirban Das Gupta: Probability and Statistics for Machine Learning, Springer.

5. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, second ed, Springer

6. Ian Goodfellow: Deeplearning, MIT Cambridge Press.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIP702

Course Name : Design Lab

Credits : 2 L - 0 T - 1 P - 2

Course Type : Core

Prerequisites: Students must have prior programming experience in C/C++ or any language; mathematics through differential equations, and numerical analysis

Course Contents

Operating Systems and Unix Environments: features of UNIX/Linux for scientific and technical computing; languages, compilers, debuggers, performance tools, make files, build systems, shell scripting, file management, source code control. Research Documentation and Simple Data Visualization: tools for generating research and code documentation: LATEX, Doxygen, plotting tools. Software Best Practices: software design cycle, regression testing, defensive programming, verification, code coverage Scientific Libraries: availability of common math libraries and usage for scientific computing. High performance Computing (HPC): Tool and techniques operating Systems and Unix Environments: features of UNIX/Linux for scientific and technical computing; languages, compilers, debuggers, performance tools, make files, build systems, shell scripting, file management, source code control. Research Documentation and Simple Data Visualization: tools for generating research and code documentation: LATEX, Doxygen, plotting tools. Software Best Practices: software design cycle, regression testing, defensive programming, verification, code coverage Scientific Libraries: availability of common math libraries and usage for scientific computing. High performance Computing (HPC): Tool and techniques.

Recommended Readings

Text Books:-

1. Eric S. Raymond, The Art of Unix Programming, Addison-Wesley 2003.

2. Heister, T. and Rebholz, L. G., Introduction to Scientific Computing for Scientists and Engineers. De Gruyter Press, 2015.

3. John Levesque, High Performance Computing: Programming and Applications

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIP704

Course Name : Security Tools Lab

Credits : 2 L - 0 T - 1 P - 2

Course Type : Core

Prerequisites: NIL

Course Contents

Etherreal/ Wireshark real time network analyzer, packet sniffing techniques ,TCPDump, Safety control using Metasploit , Vulnerability assessment using Nessus tool, Intrusion detection using Snort, Wireless safety tools, Network tracking using Nagios, Kali Linux tools, Hardware and software security tools

Recommended Readings

Text Books:-

1. On line resources

Electives Courses for CS-IS

1.	**CIL721**	Advanced Computer Networks
2.	**CIL722**	Android Programming
3.	**CIL723**	Biometrics
4.	**CIL724**	Cloud Security
5.	**CIL725**	Cyber Security
6.	**CIL726**	Data Compression
7.	**CIL727**	Deep Learning
8.	**CIL728**	Digital Forensics
9.	**CIL729**	Embedded System Security
10.	**CIL730**	Internet of Things
11.	**CIL731**	Wireless Security
12.	**CIL732**	Intrusion Detection
13.	**CIL733**	Nature Inspired Algorithms
14.	**CIL734**	Network Performance Modelling
15.	**CIL735**	Pattern Recognition
16.	**CIL736**	Program Analysis
17.	**CIL737**	Public Key Infrastructure and Trust Management
18.	**CIL738**	Quantum Cryptography
19.	**CIL739**	Security Analysis of Protocols
20.	**CIL740**	Machine Learning
21.	**CIL741**	Selected Topics in Cryptography
22.	**CIL742**	Social Network Analysis
23.	**CIL743**	Software Testing and Validation
24.	**CIL744**	VLSI Algorithms
25.	**CIL745**	Blockchain Technologies

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL721

Course Name : Advanced Computer Networks

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: None

Course Contents

Wireless networking: a. Bluetooth, 802.11 standards b. Information theory, bandwidth, multiple access c. Wireless Terahertz Networks d. 5G and 6G communication e. Intelligent Transportation Systems Emerging networking technologies: a. Host configuration and service discovery principles b. Future routing architectures c. IPv6 deployment scenarios and challenges, IPv6 transition/integration d. Advanced IP multicast, including IPv6 multicast and SSM e. Software-defined networking f. Delay-tolerant networking g. Future home network architectures h. IP network management and monitoring i. Social Networks

Recommended Readings

Text Books:-

1. Tanenbaum A S and Wetherall D J (2010). Computer Networks.

2. Hagen S, (2006). IPv6 Essentials.

3. Recent publications on the relevant fields

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL722

Course Name : Android Programming

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: None

Course Contents

Basics: Review of Java Programming, Setting up and configuring Android Studio setup, Android EmulatorHello Android example, Android Manifest.xml, R.java file, Activity, Fragment, Layout Manager - Relative Layout, Linear Layout, Table Layout, Grid Layout Activity, Intent & Fragment: Activity Lifecycle, Activity Example, Intent – implicit and explicit, Intent filters, Fragment Lifecycle, Fragment Example, UI Widgets – buttons (toggle, switch, image), check box; Android Menu: Option Menu, Context Menu, Popup Menu; View Android Service: lifecycle, example, Data Storage, Shared Preference, SQLite, Content Provider, Android Notification Adding functionality: Multimedia API, Speech API, telephony API, Location API Sensors: Sensor API, Working with WiFi, Working with Camera, Motion Sensor, Position Sensor; Android Graphics App development project

Recommended Readings

Text Books:-

1. Official Android Website

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL723

Course Name : Biometrics

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: A basic knowledge of statistics, linear algebra, and programming is expected.

Course Contents

Introduction: Person recognition, Biometric systems, Biometric functionalities, biometrics system errors, the design cycle of biometric systems. Fingerprint recognition: friction ridge patterns, fingerprint acquisition, feature extraction and matching, palm prints. Face recognition: image acquisitions, face detection, feature extraction and matching, handling pose, illumination and expression variations Iris recognition: image acquisition, Iris segmentation, Iris normalization, Iris encoding and matching, Iris quality assessment techniques Additional Biometric Traits: Ear, Gait, Hand geometry, Soft biometrics Multibiometrics: sources of multiple evidence, fusion levels: sensor, feature, score, rank and decision level fusion. Security of biometric systems: adversary attacks, attacks at user interface, attacks on biometric processing, attacks on template database.

Recommended Readings

Text Books:-

1. Introduction to Biometrics, Anil K Jain Arun Ross, Springer

2. The Science of Biometrics, Ravindra Das, Springer

3. Practical Biometrics, Julian Ashbourn, Springer

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL724

Course Name : Cloud Security

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: Computer Networks, Operating System

Course Contents

Introduction of Cloud Computing: Taxonomy and related technologies, Essential Characteristics, Service and Deployment Models. Virtualization: Types of Virtualization and Hypervisors, Virtualization at Storage, Compute and Network, Hypervisors (Types and Case studies), Virtual Machine Provisioning, Virtual Machine Migration. Architectures:Standards, Orchestration, Provisioning, Portability, Interoperability, Federated Cloud, Security: CIA Triad, Vulnerabilities in Cloud, Threats to Infrastructure, Data and Access Control;Identity Management; Multi Tenancy Issues; Attack taxonomy; Intrusion Detection, VM Specific attacks, VM Introspection, Management; Trusted Cloud Initiative of Cloud Security Alliance (CSA). Forensics: NIST Forensics Reference Architecture, Forensic Science Challenges, Architectural Issues, Evidence Collection and Analysis, Anti-Forensics, Incident Response, Standards and Framework

Recommended Readings

Text Books:-

1. K. Hwang, G. C. Fox, and J. Dongarra, Distributed and Cloud Computing, 1st ed.: Morgan Kaufmann, 2011

2. R. Buyya, J. Broberg, and A. M. Goscinski, Cloud Computing: Principles and Paradigms: Wiley-Blackwell, 2011

3. S. Dinkar and G. Manjunath, Moving to the Cloud: Developing Apps in the New World of Cloud Computing Syngress Media, U.S., 2012.

4. W. Stallings, Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud, 1st ed.: Addison-Wesley Professional, 2015.

5. T. Erl, Z. Mahmood, and R. Puttini, Cloud Computing: Concepts, Technology & Architecture: Prentice Hall/PearsonPTR, 2014.

6. R. L. Krutz and R. D. Vines, Cloud Security - A Comprehensive Guide to Secure Cloud Computing, Wiley Publishing, 2010

7. T. Mather, S. Kumaraswamy, and S. Latif, Cloud Security and Privacy - An Enterprise Perspective on Risks and Compliance, O Reilley Publishers, 2009.

8. V. (J. R.) Winkler, G. Speake, P. Foxhoven, Securing the Cloud: Cloud Computer Security Techniques and Tactics, Syngress, 2011.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL725

Course Name : Cyber Security

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: NIL

Course Contents

Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats, Need for a Comprehensive Cyber Security Policy. Cyber Security Safeguards (Overview): Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, Threat Management. Network Security & Web Security: Security Issues in TCP/IP, which includes TCP, DNS, Routing (basic problems of security in TCP/IP, IPsec, BGP Security, DNS Cache poisoning, etc), Network Defense tools such as Firewalls, Filtering, DNSSec, NSec3, Distributed Firewalls, Web Application Security: Cross-Site Scripting Attacks, Cross-Site Request Forgery, SQL Injection Attacks Intrusion, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion detection Systems, Network based Intrusion Prevention Systems, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation. Cyber Forensics: Introduction to Cyber Forensics, Handling Preliminary Investigations, Controlling an Investigation, Conducting disk-based analysis, Investigating Information-hiding, Scrutinizing E-mail, Validating Email header information, Tracing Internet access, Tracing memory in real-time. Security in Mobile Platforms: Android vs. ioS security model, threat models, information tracking, rootkits, Threats in mobile applications, analyzer for mobile apps to discover security vulnerabilities, Viruses, Spywares, and keyloggers and malware detection. Cyberspace and the Law

Recommended Readings

Text Books:-

1. Latest research papers, journals and articles

2. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and SunitBelapure.

3. Cybersecurity Essentials By Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short · 2018

4. Cybersecurity: Attack and Defense Strategies: Infrastructure Security with Red Team and Blue Team TacticsBook by ErdalOzkaya and Yuri Diogenes

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL726

Course Name : Data Compression

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: Object Oriented Analysis and Design

Course Contents

Introduction: Compression techniques, lossless compression, lossy compression, measures of performance, modeling and coding. Mathematical preliminaries - Overview, introduction to information theory, models, physical models, probability models, Markov models. Basic Coding Schemes: Statistical Methods - Shannon-Fano Algorithm, Huffman Algorithm, Adaptive Huffman Coding. Arithmetic Coding (Encoding, Decoding, Adaptive Coding). Dictionary Methods - LZ77, LZ78, LZW Algorithms. Case study of lossless compression standards. Lossless Compression standards: zip, gzip, bzip, unix compress, GIF, JBIG. Image and Video Compression: Discrete Cosine Transform, JPEG. Wavelet Methods - Discrete Wavelet Transform, JPEG 2000. Motion Compensation, Temporal and Spatial Prediction. MPEG and H.264. Audio Compression: Digital Audio, WAVE, FLAC, MPEG-1/2 Audio Layers.

Recommended Readings

Text Books:-

1. Khalid Sayood. 2012. Introduction to Data Compression (4th ed.). Elsevier.

2. David Salomon, Giovanni Motta. 2010. Handbook of Data Compression. Springer, London.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL727

Course Name : Deep Learning

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: None

Course Contents

Course Overview: Introduction to Deep Learning and its Applications. Introduction to Statistical Learning: Multi-Layer Perceptron, Back Propagation, Linear Regression, etc.Convolutional Neural Networks: Convolution, pooling, Activation Functions, Back propagation of CNN, Weights as templates, Translation invariance, Training with shared parameters.CNN Architecture Design and Discussion: AlexNet, VGG, GoogLeNet, ResNet, Capsule Net, etc. Loss Functions and Optimization: Optimization, stochastic gradient descent, dropout, batch normalization, etc.Sequential Modelling: Recurrent and Recursive Nets, RNN, LSTM, GRU, Image captioning, visual question answering, etc. Visualization and Understanding: Visualizing intermediate features and outputs, Saliency maps, Visualizing neurons, Cam-Grad, etc. Generative Models: VariationalAutoencoders, Generative Adversarial Networks like pix2pix, CycleGAN, etc. Deep Reinforcement Learning: Reinforcement Learning (RL) Background, Policy gradients, hard attention Q-Learning Deep Learning Applications: Object Detection: RCNN, Fast RCNN, Faster RCNN, YOLO, Retina Net, SSD, etc., Semantic Segmentation: DeepLabV3, PSP Net, etc. Adversarial Attacks on CNN.

Recommended Readings

Text Books:-

1. Ian Goodfellow and YoshuaBengio and Aaron Courville, “Deep Learning,” MIT Press.

2. Michael A. Nielsen, “Neural Networks and Deep Learning,” Determination Press, 2015.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL728

Course Name : Digital Forensics

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: Operating Systems, Computer Networks & Security

Course Contents

File System Forensics: Duplicating hard disks for "dead analysis", reading hidden data on a disk's Host Protected Area (HPA), Direct versus BIOS access, dead versus live acquisition, Disk partitions - DOS, Apple, and GPT partitions, BSD disk labels, Sun Volume; multiple disk volumes - RAID and disk spanning; Analyzing FAT, NTFS, Ext2, Ext3, UFS1, and UFS2 file systems, Finding evidence: File metadata, recovery of deleted files, Using The Sleuth Kit (TSK), Autopsy Forensic Browser, and related open source tools Web Forensics: network-based evidence in Windows and Unix environments, Reconstructing Web browsing, email activity, Tracing domain name ownership and the source of e-mails System Forensics: Windows Registry changes, Duplicating and analyzing the contents of PDAs and flash memory devices Electronic document, computer image verification and authentication.

Recommended Readings

Text Books:-

1. Brian Carrier. File System Forensic Analysis, Addison Wesley.

2. Chris Prosise, Kevin Mandia. Incident Response and Computer Forensics, McGraw Hill. Course Technology.

3. Linda Volonino, Reynaldo Anzaldua, and Jana Godwin. Computer Forensics: Principles and Practices, Prentice Hall.

4. Keith J. Jones, Richard Bejtlich, and Curtis W. Rose. Real Digital Forensics: Computer Security and Incident Response, Addison Wesley.

5. Vacca, John R., Computer Forensics Computer Crime Scene Investigation, Charles River Media.

6. Nelson, Phillips, Enfinger, Steuart. Guide to computer Forensics and Investigation

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL729

Course Name : Embedded System Security

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: None

Course Contents

Security Flaws and Attacks in Embedded systems: Code injection, Invasive and Non invasive physical and logical attacks Defenses Against Code Injection Attacks: Methods using Address Obfuscation and Software Encryption, Anomaly Detection. Safe Languages, Code Analyzers Compiler, Library, and Operating System Support for embedded systems. security, Control Flow Checking, IP Protection: Encryption of IP Cores, additive and Constraint-Based watermarking. Implementation of DES 3DES, AES, RC4, MD5, RSA algorithms

Recommended Readings

Text Books:-

1. Security in Embedded Hardware

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL730

Course Name : Internet of Things

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: Computer Networks, Wireless Communication

Course Contents

Introduction: Internet of Things and Connected Products, IoT paradigm, Smart objects, Goal orientation, Convergence of technologies; Business Aspects of the Internet of Things.Internet and "Things": Layers, Protocols, Packets, Services, Performance parameters of a packet network and applications: Web, Peer-to-peer, Sensor networks, and Multimedia. Hardware and Software: Hardware components, Microcontrollers and Software; Operating Systems. Protocols and Platforms -IoT Communication Protocols, Transport Protocols, Application Protocols; Cloud computing for IoT. Services and Attributes: Data creation, Data gathering and Data dependency; Robustness, Scaling, Privacy, Security, Trust. Designing & Developing IoT applications: Introduction, IoT Design Methodology, Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Date/ Time Operations, Classes, Python Packages Application: Implications for the society, IoT case study.

Recommended Readings

Text Books:-

1. The Internet of Things: Key Applications and Protocols, David Boswarthick, Olivier Hersent, and Omar Elloumi, Wiley

2. Building the Internet of Things with IPv6 and MIPv6, Daniel Minoli, Wiley.

3. Latest research articles

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL731

Course Name : Wireless Security

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: Computer Networks

Course Contents

Foundations of Wireless Security: Wireless as a necessity, advantages and disadvantages, information security and wireless LANs, wireless LAN standards and types, Wireless LAN vulnerabilities. Risks and Threats of Wireless: Social Engineering, phishing, search engine scanning, Denial-of-service, malicious code, War driving, rogue access points, RFID. Wireless Security Models: Wireless Security Basics, Equivalent Privacy Standard (WEP), Extensible Authentication Protocol (EAP), Wi-Fi Protected Access (WPA), WPA2, 802.11i, attacks on WEP, EAP, WPA, 802.11i. Designing a secure wireless network: Basic principles of security design- layering, limiting, diversity, obscurity, simplicity; network segmentation, hardware placement, wireless device security. Wireless security Policy: policy overview, risk assessment, designing security policy, impact analysis, wireless security policy areas, types of wireless security policies.

Recommended Readings

Text Books:-

1. Wireless Security Handbook, by Aaron E. Earle, Auerbach Publications

2. CWSP Guide to Wireless Security, by Mark Ciampa, 1st Edition.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL732

Course Name : Intrusion Detection

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: None

Course Contents

Introduction- Intrusion Detection System (IDS), Intrusion Prevention System (IPS), Unauthorized access – buffer overflow, packet fragmentation, out-of-spec packets Review of Network protocol – TCP/IP, Intrusion detection through tcpdump. IDS and IPS – Architecture and internals. Malicious and non-malicious traffic, IP headers, TCP, UDP and ICMP protocols and header formats, Header information to detect intrusion, logs and their analysis, IDS through reaction and response Intrusion analysis – data correlation, tools, SNORT- A case study.

Recommended Readings

Text Books:-

1. Matt Fearnow, Stephen Northcutt, Karen Frederick, and Mark Cooper. Intrusion Signatures and Analysis, SAMS.

2. Carl Endorf, Gene Schultz, Jim Mellander, Intrusion Detection and Prevention, McGraw Hill.

3. Paul E. Proctor. The Practical Intrusion Detection Handbook, Prentice Hall.

4. Stephen Northcutt and Judy Novak. Network Intrusion Detection, SAMS.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL733

Course Name : Nature Inspired Algorithms

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: Data structures

Course Contents

Introduction to Algorithms, Optimization, Search for optimality, computational intelligence, Nature Inspired solutions and characteristic, Nature inspired Metaheuristics and its brief history, Analysis of Optimization Algorithms, Nature Inspired Algorithms, parameter Tuning and controlConstrained and unconstrained optimizations, Random Walks and Optimizations, evolutionary strategies and Evolutionary Algorithms (EA), Simulated Annealing (SA) Algorithm and its behavior, Genetic Algorithms(GA)- genetic operator, parameters, fitness functions, genetic programming and convergence analysis, GA variants, Differential Evolution (DE), various Applications. Swarm Intelligence optimization, Particle Swarm Optimization(PSO) Algorithm, Ant Colony Optimization (ACO) Algorithms, Artificial Bee Colony ACO) optimization algorithms, Cuckoo Search (CS) Algorithms, Intelligent Water Drop Algorithm (IWD), Bat Algorithms(BA), Firefly Algorithms(FA) Framework for self-tuning algorithms, Dealing with constraints, constraints handling, fitness functions ,multi-objective optimization techniques and its applications , Hybrid algorithms, Ways to Hybridize.

Recommended Readings

Text Books:-

1. Nature-Inspired Optimization Algorithms – by Xin-She Yang (Author), June 30, 2016

2. Mathematical Foundations of Nature-Inspired Algorithms, Xin-She Yang, Xing-Shi He, Springer; 1st ed. 2019 edition

3. Nature-Inspired Metaheuristic Algorithms: Second Edition, Xin-She Yang, Luniver Press

4. Introduction to Evolutionary Computing, A. E Eiben and J. E. Smith, Second Printing, Springer, 2007

5. Evolutionary Algorithms in Engineering Applications, Editors: DipankarDasgupta and ZbigniewMichalewicz, Springer-Verlag, 1997

6. D. E. Goldberg, Genetic Algorithms in search, Optimization and Machine Learning, Pearson India

7. Optimization Techniques and Applications with Examples By Xin-She Yan, wiley publisher

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL734

Course Name : Network Performance Modelling

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: None

Course Contents

Introduction to Network Modeling: Network modeling, Computer Network as a discrete event system, Modeling and measurement tools, Network performance metrics – first order and second order metrics, Network capacity, Difference between throughput and capacity Network Calculus: Models for data flows, arrival curves and service curves, Greedy shapers, Basic min-plus and max-plus calculus, min-plus and max-plus systems, Optimal smoothing, FIFO systems and aggregate scheduling, Time varying shapers, Systems with losses, Case studies – (1) Analyzing spanning tree based data forwarding using network calculus, (2) Bound on loss rate Stochastic Scheduling and Resource Allocation: Stochastic scheduling, dynamic resource allocation, Dynamic programming models for stochastic scheduling, Queuing networks – open loop and closed loop networks, Jackson networks, Network fairness – proportional and max-min fairness, Markov process and its application for analyzing network resource allocation and fairness, available bandwidth estimation, Case studies – (1) TCP/IP flow and congestion control, (2) Modeling dynamic routing and scheduling as a queuing network problem, (3) Analysis of IEEE 802.11 channel access using two dimensional Markov process. Network Games: Introduction to game theory, Zero sum games, Nash equilibrium, Pareto optimality, Cooperative and Non-cooperative games, General network games – resource sharing games, routing games, congestion games, Mechanism design, Case studies – (1) Selfish routing in networks and price of anarchy, (2) Oblivious routing, (3) Network resource allocation games Protocol Analysis: Modeling discrete event system using petri-nets, basics of petri nets, stochastic petri nets, queuing petri nets, properties of petri nets, structural analysis of petri nets, Petri net modeling tools – simQPN, Case studies – (1) Wireless channel model using stochastic petri net, (2) Data center network throughput analysis using queuing Petri Nets

Recommended Readings

Text Books:-

1. "Routing, Flow, and Capacity Design in Communication and Computer Networks", MichałPióro, DeepankarMedhi, ISBN: 0125571895, Publisher: Morgan Kaufmann

2. The Network Calculus Book by Jean-Yves Le Boudec and Patrick Thiran is available for free download:http://ica1www.epfl.ch/PS_files/NetCal.htm

3. Anurag Kumar, D. Manjunath and Joy Kuri, "Communication Networking: An Analytical Approach" Morgan Kaufman Publishers

4. Dimitri P. Bertsekas and Robert G. Gallager, "Data Networks": Materials are available at http://web.mit.edu/dimitrib/www/datanets.html

5. "Network Optimization: Continuous and Discrete Models", D. Bertsekas

6. Research Publications - will be discussed and distributed time to time

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL735

Course Name : Pattern Recognition

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: An undergraduate level understanding of probability, statistics and linear algebra is assumed. A basic knowledge of Python is essential.

Course Contents

The classification process: features, training and learning, approaches to classification Non metric methods: Information, Entropy and Impurity, decision tree classifier- ID3, C4.5. Discriminant functions: linear discriminant functions, piece-wise linear discriminant functions, generalized discriminant functions. Statistical pattern recognition: measured data and measurement errors, probability theory, conditional probability and Bayes rule, Naive Bayes classifier, Continuous random variables, The multivariate Gaussian, Covariance matrix and MahalanobisdistanceParametric learning: Bayesian decision theory, discriminant functions and decision boundaries, MAP (Maximum A Posteriori Estimator)Non Parametric learning: Histogram estimator and Parzen windows, k-NN classification, Artificial Neural Networks, Kernel Machines, SVM. Feature extraction and selection: reducing dimensionality, feature selection- Inter/Intra class distance, Feature extraction: Principal component analysis, Linear discriminant analysis. Unsupervised learning: Clustering, K- Means clustering, Fuzzy c-Means clustering, (Agglomerative) Hierarchical clustering. Estimating and Comparing Classifiers: No free lunch, Bias and variance trade-off, cross-validation and resampling methods, Measuring classifier performance, Comparing classifiers- ROC curves, McNemar's test, other statistical tests.

Recommended Readings

Text Books:-

1. Pattern Classification, Duda Hart, Wiley

2. Pattern Recognition and Classification, Geoff Dougherty, Springer

3. Statistical Pattern Recognition, Andrew R Webb, Wiley

4. Pattern Recognition and Machine Learning, Christopher Bishop, Springer

5. Pattern Recognition and Image Analysis, Earl Gose, Johnsonbaugh, PHI

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL736

Course Name : Program Analysis

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: None

Course Contents

Introduction to analysis tools: debugging, disassembly, emulators, virtualization Introduction: Program Representation, Syntactic Analysis, Program Semantics, Static and dynamic analysis, Syntactic Analysis, Dataflow Analysis and Abstract Interpretation, Interprocedural analysis, Context-sensitive, Pointer analysis, Call Graph Construction, slicing and profiling, Control Flow Analysis, Dynamic Analysis for Data Race Detection Model Checking, Symbolic execution, Program Repair, Hoare Logic, SMT solvers

Recommended Readings

Text Books:-

1. Pierce, Benjamin C. Types and Programming Languages. MIT Press, 2002.

2. Winskel, Glynn. The Formal Semantics of Programming Languages: An Introduction. MIT Press, 1993.

3. Nielson, Nielson, and Hankin. Principles of Program Analysis. Springer, 2010.

4. Baier, and Katoen. Principles of Model Checking. MIT Press, 2008.

5. Chlipala, Adam. Certified Programming with Dependent Types: A Pragmatic Introduction to the Coq Proof Assistant. MIT Press, 2013.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL737

Course Name : Public Key Infrastructure and Trust Management

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: None

Course Contents

Public key infrastructure - components and architecture. PKI interoperability, deployment and assessment PKI data structures – certificates, validation, revocation, authentication, cross-certification. Repository, Certification Authority (CA) and Registration Authority (RA), trusted third party, digital certificates PKI services – authentication, non-repudiation, privilege management, privacy, secure communication. Key management – certificate revocation list, root CA, attacks on CA, key backup. PKI standards – SSL, LDAP, IPSec, X.500, X.509, S/MIME Trust models – strict v/s loose hierarchy, four corners distribution. Certificate path processing – path construction and path validation.

Recommended Readings

Text Books:-

1. AshutoshSaxena, Public Key Infrastructure, Tata McGraw Hill

2. Carlisle Adams, Steve Lloyd. Understanding PKI: Concepts, Standards, and Deployment Considerations, Addison Wesley.

3. John R. Vacca. Public Key Infrastructure: Building Trusted Applications and Web Services, AUERBACH.

4. MessaoudBenantar, Introduction to the Public Key Infrastructure for the Internet, Pearson Education.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL738

Course Name : Quantum Cryptography

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: None

Course Contents

Preliminaries: Quantum Information Theory, Quantum Information Theory, Unconditional Secure Authentication and Entropy. Quantum Key Distribution: Quantum Channel, Public Channel, QKD Gain, Finite Resources, Adaptive Cascade: Introduction, Error Correction and the Cascade Protocol, Adaptive Initial Block-Size Selection, Fixed Initial Block-Size, Dynamic Initial Block-Size. Attack Strategies on QKD Protocols: Attack Strategies in an Ideal Environment, Individual Attacks in an Realistic Environment. QKD Systems, Statistical Analysis of QKD Networks in Real-Life Environment: Statistical Methods, Results of the Experiments, Statistical Analysis. QKD Networks Based on Q3P : QKD Networks, PPP, Q3P, Routing and Transport. Quantum-Cryptographic Networks from a Prototype to the Citizen. The Ring of Trust Model, Model of the Point of Trust Architecture, Communication in the Point of Trust Model, Exemplified Communications, A Medical Information System Based on the Ring of Trust.

Recommended Readings

Text Books:-

1. Quantum Cryptography and Secret-Key Distillation, Gilles van Assche, Cambridge University Press, 2006.

2. Paul Kaye, Raymond Laflamme, and Michele Mosca, An Introduction to Quantum Computing, Oxford University Press (2007).

3. Michael A. Nielsen and Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press (2000).

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL739

Course Name : Security Analysis of Protocols

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: None

Course Contents

Cryptographic background; Authentication, Key establishment and IP security; Denial of service; Anonymity and MIX networks; Fairness and contract signing, Privacy and protection of individual information;Wireless security (mobile phones, WiFi); Protocol analysis tools: Finite-state checking; Infinite-state symbolic analysis; Probabilistic model checking;Game-based verification; Process algebras (spi-calculus and applied pi calculus); Protocol logics (BAN, DDMP, Isabelle); Introduction to Probabilistic polynomial time calculus; Relating cryptographic and formal models.

Recommended Readings

Text Books:-

1. Latest reputed conference and journal articles as chosen by the instructor.

2. Maximum Security, 2nd Edition, SAMS Books by Anonymous, 1998,

3. Maximum Linux Security, SAMS Books by Anonymous, 2000, ISBN: 0-672- 31670-6.

4. 10 Risks of PKI: What You're not Being Told about Public Key Infrastructure, by Ellison and Schneier

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL740

Course Name : Machine Learning

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: Basic understanding of probability and statistics, linear algebra and calculus. A basic knowledge of programming (preferably Python) is essential.

Course Contents

Advanced linear Algebra (e.g., SVD). The learning problem – learning versus design, types of learning- supervised, unsupervised, reinforcement and other views of learning. Linear Modelling: A least squares approach, linear modeling, making predictions, vector/matrix notation, linear regression, nonlinear response from a linear modelz. Generalization and over-fitting. The Bayesian approach to machine learning: exact posterior, marginal likelihoods Probability based learning: Bayes theorem, Bayesian prediction, conditional independence and factorization, the Naive Bayes model. Error based learning: simple linear regression, multi variable linear regression with gradient descent Logistic regression – gradient descent, non linear transformations the Z space. Similarity based learning: nearest neighbor, k- nearest neighbors, efficient distance computations: the KD trees Information based learning: learning and trees, Classification and regression trees. Ensemble methods, Boosting, Bagging, Random forests. Neural networks – the perceptron, Multilayer perceptron, activation functions, gradient descent, deriving back propagation. Multi-task and transfer learning, Deep learning. Linear discriminant analysis (LDA), Principal component analysis (PCA)SVM- optimal separation, the margin and support vectors, a constrained optimization problem, kernels – polynomial, radial basis, sigmoid Performance Measures and Evaluation – for categorical targets, prediction scores, multinomial targets, continuous targets. Clustering – the general problem, hierarchical and partitional clustering, K-means clustering.

Recommended Readings

Text Books:-

1. Learning from Data, Yaser S Abu-Mostafa, AML books

2. Machine learning, Marsland, CRC press

3. An Introduction to Machine Learning, Kubat Miroslav, Springer

4. Fundamentals of Machine Learning for predictive data analytics, John D Kelleher, MIT Press

5. Learning from Data, Yaser S Abu-Mostafa, AML books

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL741

Course Name : Selected Topics in Cryptography

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: Maths

Course Contents

Basic Concepts: Information theoretic vs. computational security. One way functions, Pseudo randomness generators and functions, Permutations, hash functions. Private-key encryption using pseudo randomness. Private-key authentication. – Public key encryption (and number theory). Public key authentication. Interactive protocols: Touch of complexity theory, Interactive proof systems; 0-knowledge proof systems,0-knowledge authentication, Electronic cash; non-interactive zero-knowledge. Oblivious transfer: Definitions, constructions, and applications, Secure Multiparty computations, Database (differential) privacy. – Proofs of work – Block-chain consensus protocols.

Recommended Readings

Text Books:-

1. Introduction to Modern Cryptography: Principles and Protocols, by Jonathan Katz and Yehuda Lindell

2. A Graduate Course in Applied Cryptography by Dan Boneh and Victor Shoup

3. The Joy of Cryptography by Mike Rosulek.

4. OdedGoldreich: Foundations of Cryptography Vol 1 and Vol2

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL742

Course Name : Social Network Analysis

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: Data Structures and Algorithms

Course Contents

Network Models: Properties of Real-World Networks: Degree Distribution, Clustering Coefficient, Average Path Length. Random Graphs , Small-World Model, Preferential Attachment Model, Modeling of Real-World Networks using Random Graphs, Small-World Model and Preferential Attachment Model Network Measures: Centrality: Degree Centrality, Eigenvector Centrality, Katz Centrality, PageRank, Centrality, Closeness Centrality, Group Centrality. Transitivity and Reciprocity, Balance and Status, Similarity: Structural Equivalence, Regular Equivalence. Community Analysis: Community Detection, Community Detection Algorithms: Member-Based Community Detection, Group-Based Community Detection. Community Evolution: How Networks Evolve, Community Detection in Evolving Networks. Community Evaluation: Evaluation with Ground Truth, Evaluation without Ground Truth Recommendation: Classical Recommendation Algorithms: Content-Based Methods, Collaborative Filtering (CF), Extending Individual Recommendation to Groups of Individuals, Recommendation Using Social Context, Evaluating Recommendations: Evaluating Accuracy of Predictions, Evaluating Relevancy of Recommendations Graph Representation Learning, Knowledge Graphs and Meta Paths, Graph Convolutional Networks, Link Prediction, Influence Maximization & Outbreak Detection.

Recommended Readings

Text Books:-

1. Networks, Crowds, and Markets: Reasoning About a Highly Connected World by David Easley and Jon Kleinberg.

2. Networks: An introduction by Mark Newman.

3. The Development of Social Network Analysis" by Linton C Freeman

4. Zafarani, Reza, Mohammad Ali Abbasi, and Huan Liu. Social media mining: an introduction. Cambridge University Press

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL743

Course Name : SOFTWARE TESTING & VALIDATION

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: Software engineering, basic computer programming skills

Course Contents

Testing Environment and Test Processes: Software Testing Environment, Overview of Software Testing Process, Organizing for Testing, Developing the Test Plan, Verification Testing, Analyzing and Reporting Test Results, Acceptance Testing. Levels of Testing, Unit Testing, Integration Testing, Defect Bash Elimination. System Testing, Usability and Accessibility Testing, Configuration Testing, Compatibility Testing. Functional and Non-functional system testing, Compliance Testing, Load Testing, Performance Testing and Security Testing. Static and dynamic testing, Black-box or functional testing, Equivalence partitioning, BVA, structural, White box or glass box testing, Mutation Testing, Data flow testing. Test Automation: Software Testing Tools, Software Test Automation, Debugging, Case study.

Recommended Readings

Text Books:-

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

2. A.P. Mathur, Foundations of Software Testing, Pearson publications

3. NareshChauhan , “Software Testing Principles and Practices ” Oxford University Press , New Delhi .

4. LleneBurnstein, “ Practical Software Testing”, Springer International Edition.

5. RenuRajani, Pradeep Oak, “Software Testing – Effective Methods, Tools and Techniques”, Tata McGraw Hill.

6. William Perry, “Effective Methods of Software Testing”, Third Edition, Wiley Publishing.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL744

Course Name : VLSI Algorithms

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: None

Course Contents

Logic synthesis & verification: Introduction to combinational logic synthesis, Binary Decision Diagram, Hardware models for High-level synthesis. VLSI Algorithms Partitioning: Problem formulation, classification of partitioning algorithms, Group migration algorithms, simulated annealing & evolution, other partitioning algorithms. Placement, floor planning & pin assignment: Problem formulation, simulation base placement algorithms, other placement algorithms, constraint-based floorplanning, floor planning algorithms for mixed block & cell design. General & channel pin assignment. Global Routing: Problem formulation, classification of global routing algorithms, Maze routing algorithm, line probe algorithm, Steiner Tree based algorithms, ILP based approaches. Detailed routing: problem formulation, classification of routing algorithms, single layer routing algorithms, two-layer channel routing algorithms, three-layer channel routing algorithms, and switchbox routing algorithms.Over the cell routing & via minimization: two layers over the cell routers, constrained & unconstrained via minimization. Compaction: problem formulation, one-dimensional compaction, two dimension-based compaction, hierarchical compaction.

Recommended Readings

Text Books:-

1. Naveed Sherwani, “Algorithms for VLSI Physical Design Automation”, 3rd

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Computer Science & Engineering

Course Code : CIL745

Course Name : Blockchain Technologies

Credits : 3 L - 3 T - 0 P - 0

Course Type : Elective

Prerequisites: Network Security, Cryptography,

Course Contents

INTRODUCTION TO BLOCKCHAIN Distributed Ledger Technology, Decentralization, Bitcoin Network and Architecture, Block in a Blockchain, Advantages over Traditional Databases, Mining Mechanism, Types of Blockchain: Public, Private, Consortium, Cryptography: Elliptic Curve Cryptography, Hash Functions, Merkle Tree, Merkle Patricia Trie, Digital Signature, Wallets and Keys, User Addresses and Privacy CRYPTO CURRENCY History, Distributed ledger, Creation of Coins, Double spending, Bitcoin protocols, Transaction in Bitcoin Network, AltCoins, Ethereum, EVM, Accounts, Transactions, Gas, Fees, Smart Contracts, Eth 2.0 MINING AND CONSENSUS Definitions, Types of Mining Algorithms, Proof of Work, Proof of Stake, Proof of Burn. Sharding Chains SMART CONTRACTS ON ETHEREUM Setting up Ethereum Node using Geth Client, Smart Contracts and DApps, Truffle, Ganache CLI, Metamask, Remix, Solidity, Writing and Deploying Smart Contracts in Solidity, Connection to Web3.js Library, Vulnerabilities in Smart Contracts, Attacks, Prevention of Attacks, Decentralized Autonomous Organization (DAO), Building an Initial Coin Offering (ICO). BLOCKCHAIN USE CASES AND APPLICATIONS Use-Cases in Cryptocurrency and Other Sectors like Finance, Voting System, and Healthcare, etc. Future of Blockchain.

Recommended Readings

Text Books:-

1. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction