Master of Technology (Cyber Security)

Department of
Computer Science & Engineering

SPUP

Sardar Patel University of Police, Security and Criminal Justice, Jodhpur
(Established Under State Legislative Assembly Act of Government of Rajasthan)

About the Department

The Department of Computer Science & Engineering was established in 2013. The department offers 2-years MTech programme in Cyber Security.

About the Programme

Cyber security is an emerging area in the field of Computer Science & Engineering. M.Tech in Cyber Security is aimed at producing the much needed highly skilled manpower in the area of Information Security. It offers many areas for specialization including: securing network(s) and allied infrastructure, securing applications, security testing, information testing, information systems auditing, penetration testing, forensic investigation and digital forensics science etc. Keeping all the facts in view this program is designed to create professionals trained in both cyber forensics and cyber security with best of technical talent.

The objectives of the course are:
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- To develop a human resource specialized in cybercrime investigation, which can be assistance to our law enforcement agencies.
- To prepare trained manpower needed for academics, R & D of ICT and related industries and research organizations.
- The approach shall be both multi-disciplinary and inter-disciplinary.

Scheme and Detailed Syllabus

M.TECH. CYBER SECURITY

[*Revised syllabus to be effective from session 2016-17 for batch 2015-17 (Only for III and IV semester) and subsequent batches.*]

Sem	Sub. Code	Title of the subject	Credits	Contact hours / week		
				L	T	P
I						
1	MTCS 11	Mathematical Foundations for Cyber Security	4	4	-	-
2	MTCS 12	Topics in Cyber Security	4	3	-	2
3	MTCS 13	Cyber Crime and IT Law	4	4	-	-
4	MTCS 14	Wireless and Adhoc Networks	4	3	-	2
5		Program Elective - I	4			
6		Open Elective - I	4			
II						
1	MTCS 21	Applied Cryptography	4	3	-	2
2	MTCS 22	Security & Privacy issues in Wireless Networks	4	3	-	2
3	MTCS 23	Web Application and Penetration Testing	4	3	-	2
4	MTCS 24	Intellectual Property Rights	4	4	-	-
5		Program Elective II	4			
6		Program Elective III	4			
III						
1	MTCS 31	Cyber Forensics, Audit and Investigation	4	3	-	2
2	MTCS 32	Dissertation I	16	-	16	-
3		Open Elective II	4			
IV						
1	MTCS 41	Dissertation II	24	-	24	-

List of Electives

Following list has to be used for offering programme elective I and II. Additional Elective can be added as and when required after taking departmental approval.

Sub. Code	Title of the subject	Credits	Contact hours / week		
			L	T	P
Program Elective I					
MTCS 101	Cloud Computing	4	4	-	-
MTCS 102	E Commerce	4	4	-	-
MTCS 103	Neural Networks	4	3	-	2
MTCS 104	Data Mining	4	3	-	2
MTCS 105	Information Security and Privacy	4	4	-	-
Program Elective II					
MTCS 106	Banking Technology and Management	4	4		
MTCS 107	Malware Analysis and Network Security	4	3		2
MTCS 108	Big Data Analytics	4	3		2
MTCS 109	Security Analysis of Protocols	4	4		
MTCS 110	Cloud Computing and Security	4	4		
MTCS 111	Introduction of evolutionary computing	4	4		
MTCS 112	Security Engineering	4	3		2
Open Elective I and II					
MTCS 121	Communication Skill and Technical Writing	4	4	-	-
MTCS 122	Research Methodology	4	4	-	-

Students can also elect subjects offered by other Departments (Post Graduate level) as Open Elective after departmental approval.

MATHEMATICAL FOUNDATIONS FOR CYBER SECURITY

Course Credits: 4 (4-0-0)   **MTCS-11**

Unit I
NUMBER THEORY: Introduction - Divisibility - Greatest common divisor - Prime numbers - Fundamental theorem of arithmetic - Mersenne primes - Fermat numbers - Euclidean algorithm - Fermat's theorem - Euler totient function - Euler's theoerem. Congruences: Definition - Basic properties of congruences - Residue classes - Chinese remainder theorem.

Unit II
ALGEBRAIC STRUCTURES: Groups – Cyclic groups, Cosets, Modulo groups - Primitive roots - Discrete logarithms. Rings – Sub rings, ideals and quotient rings, Integral domains. Fields – Finite fields – GF (p^n), GF(2^n) - Classification - Structure of finite fields. Lattice, Lattice as Algebraic system, sub lattices, some special lattices.

Unit III
PROBABILITY THEORY: Introduction – Concepts of Probability - Conditional Probability - Baye's Theorem - Random Variables – discrete and continuous- central Limit Theorem-Stochastic ProcessMarkov Chain.

Unit IV
CODING THEORY: Introduction - Basic concepts: codes, minimum distance, equivalence of codes, Linear codes - Linear codes - Generator matrices and parity-check matrices - Syndrome decoding – Hamming codes - Hadamard Code - Goppa codes.

Unit V
PSEUDORANDOM NUMBER GENERATION: Introduction and examples - Indistinguishability of Probability Distributions - Next Bit Predictors - The Blum-Blum-Shub Generator – Security of the BBS Generator.

Books recommended:
- D. S. Malik, J. Mordeson, M. K. Sen, Fundamentals of abstract algebra, Tata McGraw Hill

- P. K. Saikia, Linear algebra, Pearson Education, 2009.

- I. Niven, H.S. Zuckerman and H. L. Montgomery, An introduction to the theory of numbers, John Wiley and Sons, 2004.

- D P Bersekas and J N Tsitsiklis, Introduction to probability, Athena Scientific, 2008

- Douglas Stinson, 'Cryptography – Theory and Practice', CRC Press, 2006.

- Sheldon M Ross, "Introduction to Probability Models", Academic Press, 2003.

- C.L. Liu, 'Elements of Discrete mathematics', McGraw Hill, 2008.

- Fraleigh J. B., 'A first course in abstract algebra', Narosa, 1990.

- Joseph A. Gallian, ''Contemporary Abstract Algebra', Narosa, 1998

TOPICS IN CYBER SECURITY

Course Credits: 4 (3-0-2)   MTCS-12

Unit I
Topics in Data Structures**:** Various Trees, Linked List, Heap, Stack, Queues. Abstract Data Types using Python and C Language.

Unit II
Topics in Data Base Management Systems: Entity–Relationship model (E-R model) – E-R Diagrams, Functional Dependencies – Non-loss Decomposition, First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form- Multi-Valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form, Two Phase Commit, ACID Property, Two Phase Locking –Intent Locking – Deadlock- Serializability, Magnetic Disks – RAID – Tertiary storage – File Organization

Unit III
Topics in Algorithms: Algorithm Development, Complexity analysis, Sorting, Searching, BFS, DFS, Minimum Spanning Tree, Prim's and Kruskal';s algorithms, Greedy algorithms – Divide and conquer – Dynamic programming – backtracking– algorithm analysis

Unit IV
Topics in Operating System: Overview of operating systems, functionalities and characteristics of OS, concept of a process, operations on processes, process states, concurrent processes, process control block, process context, Job and processor scheduling, scheduling algorithms, Deadlock: prevention, detection, avoidance, banker';s algorithm, Memory organization and management, storage allocation Android OS, iOS, Linux OS file structure and security features

Unit V
Topics in Computer networks: OSI Model and each layer working, properties and related protocols in security areas.

Books recommended:
- Introduction to Algorithms by Thomas H. Cormen

- Algorithms by Dasgupta, Papadimitriou, and Vazirani

- The Practice of Programming by Kernighan

- Advanced Programming in the Unix Environment by W. Richard Stevens

- Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Tata McGraw Hill

- Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems"

- A. V. Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures and Algorithms", Pearson Education

- Andrew Tanenbaum, Modern Operating Systems, Prentice Hall.

- James F. Kuross, Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", Addison Wesley

- Andrew S. Tanenbaum, "Computer Networks"

CYBER CRIME AND IT LAW

Course Credits: 4 (4-0-0)   **MTCS-13**

Unit I
Introduction to cyber crime and cyber law, cyber space and information technology, Nature and scope of cyber crime, Jurisdiction of cyber crime.

Unit II
Important definitions under IT Act 2000, Cyber crime issues: unauthorized access, White collar crimes, viruses, malwares, worms, Trojans, logic bomb, cyber stalking, voyeurism, obscenity in internet, Software piracy,

Unit III
IT Act 2000, offences under IT Act and IT (amendment) Act, 2008. CRPC overview, Case studies, Role of intermediaries, Electronic evidence, Cyber terrorism, espionage, warfare and protected system

Unit IV
Overview of amended laws by the IT Act, 2000: The Indian Penal Code, 1860, The Indian Evidence Act, 1872, The Banker's Book Evidence Act, 1891, The Reserve Bank of India Act, 1934, Cyber Theft and the Indian Telegraph Act, 1885. Relevant Case laws. Digital Signatures and cetificate - legal issues,

Unit V
Electronic contract ,IPR and cyber space, E governance, Emerging issues in IT and Cyber laws, concept of criminal liabilty under cyber law

Books recommended:
- Cyber Security, Cyber Crime and Cyber Forensics: Applications and Perspectives, Raghu Santanam, M. Sethumadhavan, Information Science Reference

- Pfleeger, Charles P. and Shari L. Pfleeger. Security in Computing, 4th Edition. Upper Saddle River, NJ: Prentice Hall, 2008

- Rice, David. Geekonomics: The Real Cost of Insecure Software. Upper Saddle River, NJ: Pearson Education, 2008

- Cyber Security Essentials,James Graham, Ryan Olson, Rick Howard, CRC Press

- Cybercrime: Security and Surveillance in the Information Age, Douglas Thomas; Brian Loader

- Computer Crime: A Crime-Fighters Handbook by David Icove

- Crime in the Digital Age: Controlling Telecommunications and Cyberspace Illegalities, Peter N. Grabosky

- Cyberlaw – The Indian Perspective By Pavan Duggal, Saakshar Law Publications.

- Jonathan Rosenoer,"Cyber Law: The law of the Internet", Springer-Verlag, 1997

- Mark F Grady, FransescoParisi, "The Law and Economics of Cyber Security", Cambridge University Press, 2006

WIRELESS AND ADHOC NETWORKS

Course Credits: 4 (3-0-2)   **MTCS-14**

Unit I
Wireless Networking Trends, Key Wireless Physical Layer Concepts, Wireless Local Area Networks, Wireless Personal Area Networks,

Unit II
Mobile IPv4, Mobile IPv6, TCP, TCP over Wireless Networks

Unit III
GSM, General Packet Radio Services (GPRS), Universal Mobile Telecommunication System (UMTS)

Unit IV
Radio Frequency Identification (RFID), Introduction to LTE,WiMAX (Physical layer, Media access control, Mobility and Networking)

Unit V
Ad Hoc Wireless Networks, MAC protocols for Ad hoc Wireless Networks, Routing Protocols for Ad Hoc Wireless Networks,Wireless Sensor Networks,

Books recommended:
- Stalling W., " Network Security Essentials", Pearson

- Practical Packet Analysis: Using Wireshark to Solve Real-Word Network problems by Chris Sanders

- Jochen Schiller, "Mobile Communications", PHI.

- Uwe Hansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, Principles of Mobile Computing, Springer, New York, 2003

- Frank Adelstein, Sandeep KS Gupta, Golden Richard, Fundamentals of Mobile and Pervasive Computing,McGraw-Hill

- Zhang Y., Zheng J. & Ma M. (2008): Handbook of Research on Wireless Security, Information Science Reference.

- Butty L. &Hubaux J.P. (2007): Security and Cooperation in Wireless Networks: Thwarting Malicious and Selfish Behavior in the Age of Ubiquitous Computing, Cambridge University Press.

- Wireless Ad hoc and Sensor Networks – Protocols, Performance and Control, JagannathanSarangapani, CRC Press, Taylor & Francis Group, 2007, rp 2010

APPLIED CRYPTOGRAPHY

Course Credits: 4 (3-0-2)   **MTCS-21**

Unit I

Foundations – Protocol Building Blocks - Basic Protocols - Intermediate Protocols - Advanced Protocols - Zero-Knowledge Proofs - Zero-Knowledge Proofs of Identity -Blind Signatures - Identity-Based Public-Key Cryptography - Oblivious Transfer - Oblivious Signatures - Esoteric Protocols

Unit II

Key Length - Key Management - Electronic Codebook Mode - Block Replay - Cipher Block Chaining Mode - Stream Ciphers - Self-Synchronizing Stream Ciphers - Cipher-Feedback Mode - Synchronous Stream Ciphers - Output-Feedback Mode - Counter Mode - Choosing a Cipher Mode - Interleaving - Block Ciphers versus Stream Ciphers - Choosing an Algorithm - PublicKey Cryptography versus Symmetric Cryptography - Encrypting Communications Channels - Encrypting Data for Storage - Hardware Encryption versus Software Encryption - Compression, Encoding, and Encryption - Detecting Encryption – Hiding and Destroying Information.

Unit III

Information Theory - Complexity Theory - Number Theory - Factoring - Prime Number Generation - Discrete Logarithms in a Finite Field - Data Encryption Standard (DES) – Lucifer -Madryga - NewDES - GOST – 3 Way – Crab – RC5 - Double Encryption - Triple Encryption - CDMF Key Shortening – Whitening

Unit IV

Pseudo-Random-Sequence Generators and Stream Ciphers – RC4 - SEAL - Feedback with Carry Shift Registers - Stream Ciphers Using FCSRs - Nonlinear-Feedback Shift Registers - System-Theoretic Approach to Stream-Cipher Design - Complexity-Theoretic Approach to Stream-Cipher Design - N- Hash - MD4 - MD5 - MD2 - Secure Hash Algorithm (SHA) - OneWay Hash Functions Using Symmetric Block Algorithms - Using Public-Key Algorithms - Message Authentication Codes

Unit V

RSA - Pohlig-Hellman - McEliece - Elliptic Curve Cryptosystems -Digital Signature Algorithm (DSA) - Gost Digital Signature Algorithm - Discrete Logarithm Signature Schemes - Ongchnorr-Shamir -Cellular Automata - Feige-Fiat-Shamir -Guillou-Quisquater - Diffie-Hellman - Station-to-Station Protocol -Shamir's Three-Pass Protocol - IBM Secret-Key Management Protocol - MITRENET - Kerberos - IBM Common Cryptographic Architecture.

Books recommended:
- Bruce Schneier, "Applied Cryptography: Protocols, Algorithms, and Source Code in C" John Wiley & Sons, Inc, 2nd Edition, 1996.

- Wenbo Mao, "Modern Cryptography Theory and Practice", Pearson Education, 2004

- AtulKahate, "Cryptography and Network Security", Tata McGrew Hill, 2003.

- William Stallings, "Cryptography and Network Security, Prentice Hall, New Delhi, 2006.

- Bernard Menezes, "Network Security and Cryptography", Cengage Learning, New Delhi, 2010

SECURITY & PRIVACY ISSUES IN WIRELESS NETWORKS

Course Credits: 4 (3-0-2)   **MTCS-22**

Unit I
How existing wireless networks are secured: GSM, UMTS, WEP, IEEE 802.11i, Public Wifi hotspots, Bluetooth

Unit II
Mobile IPv6, Protection and Privacy in Mobile IPv6, Vehicular Ad-hoc Networks: vulnerabilities, challenges, Security architecture

Unit III
Naming & addressing principles, attacks and protection techniques

Unit IV
Multi hop wireless networks: Position & topology base ad-hoc routing protocols, Proactive and Reactive routing protocols. Route disruption, diversion, routing state based attacks, SRP, Ariadne, SAODV, ARAN, SMT secure routing protocols

Unit V
Misbehaviour at MAC layer of CSMA/CA, its impact and preventive measures

Books recommended:
- K Makki, P Reiher,et. all. "Mobile and Wireless Network Security and Privacy",Springer, 2007.

- LeventeButtyan, J P Hubaux. "Security and Cooperation in Wireless Networks", Cambridge University Press, 2008.

WEB APPLICATION AND PENETRATION TESTING

Course Credits: 4 (3-0-2)   **MTCS-23**

Unit I
Web Fundamentals – HTML, HTTP, Client-side scripting, Server-side scripting; Web server architecture - Windows & Linux, IIS and LAMP servers, Network topologies and DMZ

Unit II
Web applications: Introduction to web applications, Web application hacking, Overview of browsers, extensions, and platforms

Unit III
Attacks, detection evasion techniques, and countermeasures for the most popular web platforms, including IIS, Apache, PHP, and ASP.NETAttacks and countermeasures for common web authentication mechanisms, including password-based, multifactor (e.g., CAPTCHA), and online authentication services like Windows Live ID.

Unit IV
Advanced session analysis, hijacking, and fixation techniques, cross-site scripting, SQL injection, classic categories of malicious input, Overlong input (like buffer overflows), canonicalization attacks (like the infamous dot-dot-slash), and meta characters (including angle brackets, quotes, single quote, double dashes, percent, asterisk, underscore, newline, ampersand, pipe, and semicolon), beginner-to-advanced SQL injection tools and techniques, stealth-encoding techniques and input validation/ output-encoding countermeasures.

Unit V
Web services vulnerabilities discovery and exploited through techniques including WSDL disclosure, input injection, external entity injection, and XPath injection. Web application management attacks against remote server management, web content management/authoring, admin misconfigurations, and developer-driven mistakes. Web browser exploits

Books recommended:
- Hacking Exposed Web Applications, 3rd edition, JOEL SCAMBRAY, VINCENT LIU, CALEB SIMA

- The Web Application Hacker's Handbook Discovering and Exploiting Security Flaws By Dafydd Stuttard, Marcus Pinto

- Rich Bowen, Ken Coar, "Apache Cookbook", O'Reilly

- Open Web Application Security Project. A Guide to Building Secure Web Applications and Web Services. http://www.owasp.org/index.php/Category:OWASP_Guide_Project

INTELLECTUAL PROPERTY RIGHTS

Course Credits: 4 (4-0-0)   **MTCS-24**

Unit I
Introduction to Copyrights, Protected works, Ownership, Rights conferred by Copyright, Limitations, and Assignment of Copyrights Branding, Trademarks, Meaning, Functions, Features, Registration of trademark, Licensing, and Infringement of Trademark, Service Mark, Registered marks

Unit II
Introduction to Patents, Conditions of Patentability, Rights of Patentee, Procedure of obtaining Patent, Exceptions Industrial Design, Meaning of design, Registration of Design, Rights granted to Proprietor of Design, Infringement of Design

Unit III
IPRs in Digital / Technology Environment, Patent of Computer Programs, Computer software's and Copyright Law, Software Licenses, Computer database and Law, Domain Names, Disputes, Web related Issues, Semiconductor Layout and Design

Unit IV
International and National Framework for Protection of IP and Agreements under WIPO, Primary legislations regulating IP in India

Unit V
IP Management and Audit, Concept of Monopoly, Business of Licensing, Royalty, Trade Secrets,

Books recommended:
- Law Relating to Intellectual Property Rights by VK Ahuja

- Law Relating to Intellectual Property by Dr. B.L. Wadhera

- Intellectual Property Rights in the WTO and Developing Countries by JayashreeWatal

- Intellectual Property: Valuation, Exploitation, and Infringement Damages by Russell L.

- Parr , Gordon V. Smith Intellectual Property Law in India by P.S. Narayana

CYBER FORENSICS, AUDIT AND INVESTIGATION

Course Credits: 4 (4-0-0)   **MTCS-31**

Unit I
File systems, Microsoft file structure, Examining NTFS disks, Macintosh file structure and boot process, UNIX and Linux disk structures and boot processes. Other Disk structures (CD, SCSI, IDE and SATA devices)

Unit II
Commercial Forensic Tools (Encase, FTK), Advanced Features of forensic tools (search, encryption and decryption, data carving, memory analysis, advanced file system analysis (deleted and hidden data, metadata, temporary file, unknown\executable file analysis), applied decryption.

Unit III
Locating and recovering files, Identifying unknown file formats, Microsoft BitLocker, Third-Party Disk Encryption Tools, Windows Registry, Start-up Tasks.

Unit IV
Virtual Machines, Network Forensics, Network tools, E-mail Investigation, E-mail forensics tools, Mobile Device Forensic.

Unit V
Computer Investigation,Evidence acquisition, Processing crime and Incidence scene, Preserving, Analysis, Digital forensic investigation procedures, Report writing, Ethics

Books recommended:
- Law Relating to Intellectual Property Rights by VK Ahuja

- Computer Evidence - Collection and Preservation.Brown, C.L.T. Course Technology CENGAGE Learning.

- Guide to Computer Forensics And Investigations Nelson, Bill ; Phillips, Amelia; Enfinger,

- Frank; Steuat, Christopher Thomson Course Technology.

- Scene of the Cybercrime. Shinder, Debra Littlejohn and Tittel, Syngress

- Computer Forensics – Computer Crime Scene Investigation.Vacca, John R. Charles RiverMedia

- Bunting, Steve and William Wei. EnCase Computer Forensics: The Official EnCE: EnCaseCertifed Examiner Study Guide. Sybex, 2006

- Prosise, Chris, Kevin Mandia, and Matt Pepe. Incident Response: Computer Forensics. McGraw-Hill,

- Casey, Eoghan, ed. Handbook of Computer Crime Investigation, Forensic Tools andTechnology, Academic press

- Carrier, Brian. File System Forensic Analysis. Addison-Wesley Professional

DISSERTATION I

Course Credits: 16 (0-16-0)   **MTCS-32**

This is the first part of the major dissertation wherein every student shall be expected to contribute to domain knowledge incrementally. It is expected that the work should be focused in a particular area for concept, design, implementation and analysis. For this first part of 16 credits, internal assessment shall be done by the department after an open seminar with a feedback to department coordinator.

DISSERTATION II

Course Credits: 24 (0-24-0)   **MTCS-41**

This will be culmination of Dissertation I of semester III. In this Stage-II the evaluation shall be done through an Open seminar with an External Examiner, who shall be an expert in Dissertation research domain. Dissertation report shall be submitted with abstract in a standardised template for uniform submission.

CLOUD COMPUTING

Course Credits: 4 (4-0-0)   MTCS-101

Unit I
Overview of Computing Paradigm. Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing. Evolution of cloud computing: Business driver for adopting cloud computing. Introduction to Cloud Computing: Cloud Computing (NIST Model), Properties, Characteristics & Disadvantages. Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloudcomputing vs. Cluster computing vs. Grid computing.Role of Open Standards

Unit II
Cloud Computing Architecture: Service Models (XaaS), Deployment Models (Public, Private, Hybrid, Community), IaaS: Introduction to virtualization, Different approaches tovirtualization, Hypervisors, Machine Image, Virtual Machine(VM), Resource Virtualization (Server, Storage, Network) , Examples (Amazon EC2, Eucalyptus)

Unit III
Platform as a Service(PaaS), Service Oriented Architecture (SOA), Cloud Platform and Management, Google App Engine, Microsoft Azure. Software as a Service(SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS, Case Study on SaaS

Unit IV
Cloud Security: Infrastructure Security, Network level security, Host level security, Application level security, Data security and Storage, Data privacy and security Issues, Jurisdictional issues raised by Datalocation, Identity & Access Management, Access Control, Authentication in cloud computing, Client access in cloud, Cloud contractingModel, Commercial and business considerations. Case Study on Open Source & Commercial Clouds (Eucalyptus, Microsoft Azure, Amazon EC2)

Unit V
MapReduce, (Paradigm, Scheduling, Fault-Tolerance), Gossip (Multicast Problem, Protocol, Analysis, Implementations),Membership (Group Membership List, Failure Detectors, Gossip-Style Membership, bestfailure detector, Another Probabilistic Failure Detector, Dissemination and suspicion),Grids (Applications, Infrastructures), Datacenter Outage Studies

Books recommended:

- Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010

- Cloud Computing, Thomas Earl, Pearson, 2014

- Cloud Computing: Principles and Paradigms, Editors: RajkumarBuyya, James Broberg,Andrzej M. Goscinski, Wiley, 2013

- Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012

- Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz,Russell Dean Vines, Wiley-India, 2010

E COMMERCE

Course Credits: 4 (4-0-0)   **MTCS-102**

Unit I
Traditional commerce and E commerce – Internet and WWW – role of WWW – value chains – strategic business and Industry value chains – role of E commerce.

Unit II
Packet switched networks – TCP/IP protocol script – Internet utility programmes , HTML, XML, XAML, SOA – web client and servers – Web client/server architecture – intranet and extranets.

Unit III
Web server – performance evaluation - web server software feature sets – web server software and tools – web protocol – search engines – intelligent agents –EC software – web hosting – cost analysis, Google and Facebook Ads case study

Unit IV
Computer security classification – copy right and Intellectual property – electronic commerce threats – protecting client computers – electronic payment systems – electronic cash – strategies for marketing – sales and promotion – cryptography – authentication.

Unit V
Definition and capabilities – limitation of agents – security – web based marketing – search engines and Directory registration – online advertisements – Portables and info mechanics – website design issues, BotNet and its infrastructure.

Books recommended:

- Ravi Kalakota, " Electronic Commerce", Pearson Education,

- Gary P Schneider "Electronic commerce", Thomson learning & James T Peny Cambridge USA, 2001

- Manlyn Greenstein and Miklos "Electronic commerce" McGraw-Hill, 2002.

- EfraimTurvanJ.Lee, David kug and chung, "Electronic commerce" Pearson Education Asia 2001.

- Brenda Kienew E commerce Business Prentice Hall, 2001.

- E - Commerce : Business, Technology, Society- 2016 Edition 10 by by Kenneth C. Laudon, Pearson Education

NEURAL NETWORKS

Course Credits: 4 (3-0-2)   **MTCS-103**

Unit I

Neural network, Human Brain, Models of a Neuron, Neural networks as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks. Learning– Error Correction learning, Memory based learning, Hebbian learing

Unit II

Learning: Competitive, Boltzmann learning, Credit Assignment Problem, Memory, Adaption, Statistical nature of the learning process. Single Layer Perceptrons: – Adaptive filtering problem, Unconstrained Organization Techniques, Linear least square filters, least mean square algorithm, learning curves, Learning rate annealing techniques, perception –convergence theorem, Relation between perception and Bayes classifier for a Gaussian Environment

Unit III

Multi Layer Perceptrons – Back propagation algorithm XOR problem, Heuristics, Output representation and decision rule, Computer experiment, feature detection Back Propagation - back propagation and differentiation, Hessian matrix, Generalization, Cross validation, Network pruning Techniques, Virtues and limitations of back propagation learning, Accelerated convergence, supervised learning

Unit IV

Self Organization Maps: Two basic feature mapping models, Self organization map, SOM algorithm, properties of feature map, computer simulations, learning vector quantization, Adaptive patter classification, Hierarchal Vector quantilizer, contexmel Maps

Unit V

Neuro Dynamics: Dynamical systems, stavility of equilibrium states, attractors, neurodynamical models, manipulation of attractors' as a recurrent network paradigm. Hopfield models and experiments

Books recommended:

- Neural networks A comprehensive foundations, Simon Hhaykin, Pearson Education 2nd Edition 2004

- Artificial neural networks - B.Vegnanarayana Prentice Halll of India P Ltd 2005

- Neural networks in Computer intelligence, Li Min Fu TMH 2003

- Neural networks James A Freeman David M S kapura Pearson Education 2004

DATA MINING

Course Credits: 4 (3-0-2)   **MTCS-104**

Unit I
Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining.
Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

Unit II
Mining Frequent Patterns, Associations and Correlations: Basic Concepts, Efficient and Scalable Frequent Itemset Mining Methods, Mining various kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining

Unit III
Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction, Accuracy and Error measures, Evaluating the accuracy of a Classifier or a Predictor, Ensemble Methods

Unit IV
Cluster Analysis Introduction :Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis - Mining Streams, Time Series and Sequence Data: Mining Data Streams, Mining Time-Series Data, Mining Sequence Patterns in Transactional Databases, Mining Sequence Patterns in Biological Data, Graph Mining, Social Network Analysis and Multi relational Data Mining

Unit V
Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web. - Applications and Trends in Data Mining: Data Mining Applications, Data Mining System Products and Research Prototypes, Additional Themes on Data Mining and Social Impacts of Data Mining.

Books recommended:

- Data Mining – Concepts and Techniques - Jiawei Han & Micheline Kamber, Morgan Kaufmann Publishers, 2nd Edition, 2006.

- Introduction to Data Mining – Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson education.

- Data Mining Techniques – Arun K Pujari, University Press

INFORMATION SECURITY AND PRIVACY

Course Credits: 4 (4-0-1)   **MTCS-105**

Unit I
Passwords, security questions, challenge-response, Cryptographic hash functions, Biometrics, Phishing

Unit II
Web security model, Web authentication and session management, Cross-site request forgery, SQL injection, cross-site scripting, Logic flaws in Web applications, Clickjacking

Unit III
Online tracking, Symmetric encryption, Kerberos, Memory corruption attacks and defenses, Viruses and rootkits.

Unit IV
Spam, Attacks on TCP/IP, DNS, BGP. Denial of service, Worms and botnets, Stuxnet

Unit V
Firewall and intrusion detection, Public Key Cryptography, SSL and certificates, Anonymity networks, Side channel attacks: acoustics and reflections

Books recommended:

- Network Security (2nd edition) by Kaufman, Perlman, and Speciner -- required textbook!

- Security Engineering by Anderson

- The Art of Intrusion by Mitnick and Simon

- The Shellcoder's Handbook by Koziol et al.

- Secure Programming for Unix and Linux HOWTO by Wheeler

- Network Security Essentials by Stallings

BANKING TECHNOLOGY AND MANAGEMENT

Course Credits: 4 (4-0-0)   **MTCS-106**

Unit I
Branch Operation and Core Banking: Introduction and Evolution of Bank Management, Technological Impact in Banking Operations, Total Branch Computerization, Concept of Opportunities, Centralized Banking, Concept, Opportunities, Challenges & Implementation.

Unit II
Delivery Channels: Overview of delivery channels, Automated Teller Machine (ATM), Phone Banking, Call centers, Internet Banking, Mobile Banking, Payment Gateways, Card technologies, MICR electronic clearing

Unit III
Back office Operations: Bank back office management, Inter branch reconciliation, Treasury Management, Forex Operations ,Risk Management, Data centre Management,Net work Management, Knowledge Management (MIS/DSS/EIS, Customer Relationships Management(CRM)

Unit IV
Interbank Payment System: Interface with Payment system Network, Structured Financial Messaging system – Electronic Fund transfer, RTGSS, Negotiated Dealing Systems & Securities Settlement Systems, Electronic Money, and E Cheques.

Unit V
Contemporary Issues in Banking Techniques: Analysis of Rangarajan Committee Reports, E Banking, Budgeting, Banking Software's, Case study: Analysis of Recent Core Banking Software

Books recommended:
- Jessica Keyes, "Financial Services Information Systems", Auerbach publication; 2nd Edition, 2000.

- Kaptan S S and Choubey N S., "E-Indian Banking in Electronic Era", Sarup & Sons, New Delhi, 2003.

- Vasudeva, "E – Banking", Common Wealth Publishers, New Delhi, 2005.

- Turban Rainer Potter, "Information Technology", John Wiley & Sons Inc., 2005.

MALWARE ANALYSIS AND NETWORK SECURITY

Course Credits: 4 (4-0-0)   **MTCS-107**

Unit I
Basic Static Analysis, Basic Dynamic Analysis, x86, IDA, Code Constructs

Unit II
WinAPI, Handles, Windows Internals, Networking, Debugging Concepts and Tools, Malicious Activities and Techniques

Unit III
Hiding Data, Malware Countermeasures, Covert Launching and Execution, Anti Disassembly, VM, Debugging, Anti Virus

Unit IV
Packers, Packing, and Unpacking, Kernel Basics, Windows Kernel API, Windows Drivers, Kernel Debugging

Unit V
Hooking, Patching, Kernel Object Manipulation, Covert Channels, AntiForensics

Books recommended:
- "Practical Malware Analysis" by Michael Sikorski and Andrew Honig

- "The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System" Second Edition by Reverend Bill Blunden

- "Rootkits: Subverting the Windows Kernel" by Jamie Butler and Greg Hoglund

- "Practical Reverse Engineering" by Dang, Gazet, Bachaalany

BIG DATA ANALYTICS

Course Credits: 4 (3-0-2)   **MTCS-108**

Unit I
Competitive Advantage Definition: Old and New Notions, the Role of Big Data on Gaining Dynamic, Competitive Advantage, Big Data Driven Business Models, Organizational Challenges. Big Data and Analytics for Government Innovation: Governmental Challenges, Smart City Readiness, Learn to Collaborate, Legal Framework Development

Unit II
Big Data and Education: Massive Digital Education Systems: MOOC Educational Model Clusters, Institutional Advantages and Opportunities from MOOCs, Institutional Challenges from MOOCs. Big Data Driven Business Models: Implications of Big Data, for Customer Segmentation, for Value Proposition, for Channels, on Customer Relationships, on Revenue Stream, on Key Resources and Key Partnerships, Organizational Advantages and Opportunities, Organizational Challenges and Threats.

Unit III
Big Data Governance: Big Data Types, Big Data Maturity Models, TDWI Maturity Model, Analytics Business Maturity Model, Data Flux Data Governance Maturity Model, Gartner Maturity Model, IBM Data Governance Maturity Model, Organizational Challenges Inherent with Governing Big Data, Organizational Benefits of Governing Big Data.

Unit IV
Big Data and Digital Business Evaluation: Digital Business Evaluation Using Big Data, Organizational Advantages and Opportunities, Customer Value Proposition, Customer Segmentation, Channels, Customer Relationship, Organizational Challenges.

Unit V
New Big Data Tools to Drive Innovation, The Hadoop Platform, 1010 DATA Cloud Analytics, Actian Analytics, Cloudera, Models of Big Data Change , Big Data Business Model, The Maturity Phases of Big Data Business Model, Big Data Change Key Issue, Organizational Challenges, Data Acquisition, Information Extraction, Data Integration, Aggregation, and Representation

Books recommended:
- Big Data Analytics with R and Hadoop by Vignesh Prajapati, Packt Publication

- Big Data Bootcamp by David Feinleib, Apress Publication

- Big Data and Analytics by Vincenzo Morabito, Springer

- Data Mining Concepts and Techniques, 3rd Edition, Jiawei Han & Micheline Kamber

SECURITY ANALYSIS OF PROTOCOLS

Course Credits: 4 (4-0-0)   **MTCS-109**

Unit I
Introduction: Security protocols, Security properties, Public-key certificates and infrastructures, Cryptographic hash functions, Digital signatures, Security protocol vulnerabilities

Unit II
Security Protocols: Needham- Schroeder public-key protocol and its security analysis, Protocols for anonymity, Anonymity and MIX networks, Fairness and contract signing, Fair exchange and contract signing protocols, Game-based verification of contract signing protocols. Yahalom protocol: Secrecy, Authentication, Non-repudiation, Anonymity; Dolev-Yao threat model.

Unit III
Finite-state checking (Murphi), Infinite-state symbolic analysis (SRI constraint solver), Probabilistic model checking (PRISM)

Unit IV
CSP: Basic building blocks, Parallel operators, Process behaviour, Modelling security protocols in CSP - Trustworthy processes, Modelling an intruder, protocol goals.

Unit V
Transformations: Transformations on protocols, Safe simplifying transformations, Structural transformations. Formal analysis: Formal definitions of security for symmetric ciphers, Formal model for secure key exchange. Theorem proving - Rank functions, Secrecy of shared key, Authentication.

Books recommended:
- Peter Ryan, Steve Schneider, Michael Goldsmith, Gavin Lowe, Bill Roscoe: Modelling & Analysis of Security Protocols, Addison Wesley.

- Stephen W. Mancini: Automating Security Protocol Analysis, Storming Media.

- Selected papers and online material

CLOUD COMPUTING AND SECURITY

Course Credits: 4 (4-0-0)   **MTCS-110**

Unit I
Security Concepts: Confidentiality, privacy, integrity, authentication, non-repudiation, availability, access control, defence in depth, least privilege, how these concepts apply in the cloud, what these concepts mean and their importance in PaaS, IaaS and SaaS. e.g. User authentication in the cloud; Cryptographic Systems- Symmetric cryptography, stream ciphers, block ciphers, modes of operation, public-key cryptography, hashing, digital signatures, public-key infrastructures, key management, X.509 certificates, OpenSSL

Unit II
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, storage considerations, backup and recovery; Virtualization System Vulnerabilities- Management console vulnerabilities, management server vulnerabilities, administrative VM vulnerabilities, guest VM vulnerabilities, hypervisor vulnerabilities, hypervisor escape vulnerabilities, configuration issues, malware (botnets etc)

Unit III
Virtualization System specific attacks Guest hopping, attacks on the VM (delete the VM, attack on the control of the VM, code or file injection into the virtualized file structure), VM migration attack, hyperjacking.

Unit IV
Virtualization based sandboxing; Storage Security- HIDPS, log management, Data Loss Prevention. Location of the Perimeter

Unit V
Responsibility, ownership of data, right to penetration test, local law where data is held, examination of modern Security Standards (eg PCIDSS), how standards deal with cloud services and virtualization, compliance for the cloud provider vs. compliance for the customer

Books recommended:
- Tim Mather, Subra Kumaraswamy, Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance" O'Reilly Media; 1 edition, 2009.

- Ronald L. Krutz, Russell Dean Vines, "Cloud Security", 2010.

- John Rittinghouse, James Ransome, "Cloud Computing" CRC Press; 1 edition, 2009.

- J.R. ("Vic") Winkler, "Securing the Cloud" Syngress, 2011.

- Cloud Security Alliance, "Security Guidance for Critical Areas of Focus in Cloud Computing".

- Vmware "VMware Security Hardening Guide" White Paper, June 2011

- Cloud Security Alliance 2010, "Top Threats to Cloud Computing" Microsoft 2013.

- Evelyn Brown NIST "Guide to Security for Full Virtualization Technologies", 2011.

INTRODUCTION TO EVOLUTIONARY COMPUTING

Course Credits: 4 (4-0-0)   **MTCS-111**

Unit I
Introduction, Inspiration from Biology (Darwinian evolution, genetics)
Evolutionary Algorithms: Components, representation, evaluation function, population, parent selection, variation operators, replacement, Initialisation, termination. Knapsack problem

Unit II
Genetic Algorithms: Representation, Mutation, Recombination, Population, Parent selection, Types of survivor selection, Example: Scheduling problem

Unit III
Evolutionary Strategies, Evolutionary Programming,
Example application: Ackley function, evolving checkers players

Unit IV
Genetic Programming: Representation, Mutation, Recombination, Population, Parent selection, Types of survivor selection, Examples

Unit V
Classifier Systems: ZCS: A ``Zeroth Level'' Classifier System, XCS, Extensions, Example: Modelling financial market traders

Books recommended:
- A.E. Eiben and J.E. Smith, Introduction to Evolutionary Computing

SECURITY ENGINEERING

Course Credits: 4 (4-0-0)   **MTCS-112**

Unit I
Introduction to Security Engineering. Passwords and their limitations, attacks on passwords, CAPTCHA, Biometrics.

Unit II
Access Control: ACL, sandboxing, virtualization, trusted computing. Multi-level and Multi-lateral security.

Unit III
Securing services: Security in Metered Services, pre-payment meters. Secure printing and Seals. Tamper resistance mechanisms.

Unit IV
Secure systems: hardware, software and communication systems – design issues and analysis. Secure software architecture: models and principles, hardware design related security – smart cards and other security solutions, communication protocols and application systems associated with security.

Unit V
Attacks and defenses: Phishing, social networking attacks, Denial of service, API attacks, network attacks and countermeasures.

Books recommended:
- Ross J. Anderson: Security Engineering: A Guide to Building Dependable Distributed System. Wiley.

- Selected papers and online material.

COMMUNICATION SKILL AND TECHNICAL WRITING

Course Credits: 4 (4-0-0)   **MTCS-121**

Unit I
Communication Introduction & Theory:
Communication- Definition and Process
Verbal and Non Verbal Communication
Barriers to Communication.

Unit II
Oral Communication skills:
Speaking skills
Barriers to speaking effectively
Group communication, Role Play, Group discussion
Listening skills, barriers to active listening, asking questions and answering them

Unit III
Writing Communication:
CV, Letters, Application & Resume Writing,
Writing a good presentation

Unit IV
English grammar and Pronunciation:
Common errors in English pronunciation
Vocabulary Building- Synonyms, Antonyms (Selected)
Grammar- identify errors in the use of nouns, pronouns, verbs, articles, determiners, concord & prepositions, phrasal verbs & idioms, passage reading and analysis

Unit V
Presentation skills, writing a good presentation, Scientific writing and technical writing.

Books recommended:
- Bhaskar W.W.S. and Prabhu N.S. – English through reading, book I & II, Macmillan 1975.

- Leech, Geoffrey and savtvik, Jan – Communicative Grammar of English, Longman, Delhi 2001.

- Thomson and Martinet – Practical English, OUP 1970

- J.D. O'Connor, Better English Pronunciation, Cambridge University Press, 2010.

- How to build a better vocabulary – Maxwell, Nurnbey, Morris, Roesmblom.

- Allan and Barbara Pearse – The Definitive Book of Body Language.

- Michael MC Carthy, Felicity O Dell – English Vocabulary in use.

- Hancock Mark – English Pronunciation is use intermediate, CENGAGE learning

RESEARCH METHODOLOGY

Course Credits: 4 (4-0-0)   **MTCS-122**

Unit I
Introduction to Computer Science Research: What is Research? Types of Research, Why Research, Significance & Status of Research in Computer Science. Steps in Research: Having grounding in Computer Science, Major Journals & Publication in Computer Science, Major Research areas of Computer Science, Identification, selection & Formulation of research problem, Hypothesis formulation, Developing a research proposal, Planning your research, The wider community, Resources and Tools, How engineering research differs from scientific research.

Unit II
Basic of Computer Science Research, Introduction to formal models and Computability: Turing Machine & Computability, Undecidability, Diagonalization and Self-reference, reductions, Introduction to basic techniques for designing algorithms: Divide and conquer, Dynamic programming, Analysis of Algorithms

Unit III
Research Data: What is data, Mathematical statistics and computer science views on data analysis, Methods for finding associations: regression and pattern recognition, Method for aggregation and visualisation: principal components and clustering, Hypothesis testing.

Unit IV
Literature Survey: Finding out about your research area, Literature search strategy, Writing critical reviews, Identifying venues for publishing your research.

Unit V
Writing papers and the review process: preparing and presenting your paper. The conference review process, making use of the referees' reports. The journal review process, Group exercise in reviewing research papers. Thesis Writing: planning the thesis, writing the thesis, Thesis structure, writing up schedule, the oral examination and viva voice

Books recommended:
- Research Methods By Francis C. Dane, Brooks/ Cole Publishing Company, California.

- Basic of Qualitative Research (3rd Edition) By Juliet Corbin & Anselm Strauss, Sage Publications (2008)

- The Nature of Research: Inquiry in Academic Context By Angela Brew, Routledge Falmer (2001)

- Research Methods By Ram Ahuja, Rawat Publications (2001)