Syllabus Booklet

Master of Technology (Cyber Security)

Department of
Computer Science & Engineering

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

About the Departme0nt

Duration of the M.Tech Programme in Cyber Security = 2 Years

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 cyber crime 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. in Cyber Security

Subject Code	Subject Name	Credits
I Semester		
MSCS-11	Advanced Mathematics	4
MSCS-12	Advance Concepts of Information Technology	4
MSCS-13	Cyber Crime, IT Law and Information Security Management	4
MSCS-14	Elective I	4
MSCS-15	Language and Communication Skills (Audit Course)	-
II Semester		
MSCS-21	Mobile And Wireless Security	4
MSCS-22	TCP/IP and Network Security	4
MSCS-23	Applied Cryptography	4
MSCS-24	Elective II	4
MSCS-25	Behavioral Science (Audit Course)	-
III Semester		
MSCS-31	Cyber Forensics, Audit and Investigation	4
MSCS-32	Web Application Security	4
MSCS-33	Database Security	4
MSCS-34	Elective III	4
MSCS-35	Research Methodology (Audit Course)	-
IV Semester		
MSCS-41	Dissertation	20

List of Electives (Program /Open Elective)

Additional electives can be added as and when required after taking departmental approval.

Semester	Subject Code	Subjects
I	MSCS-14	▪ Intellectual Property Right in Digital Environment ▪ Disaster Management w.r.t. Cyber Security ▪ Social Networking w.r.t. Cyber Security
II	MSCS-24	▪ Banking Technology Management ▪ Cyber Security Models
III	MSCS-34	▪ Security Analysis of Protocols ▪ Cloud Computing And Security ▪ Big Data & Analytics ▪ Case Study ▪ Network finger printing & Access control. ▪ Internet Architecture & 4GLs

List of Practical Labs

Semester	Subject Code	Practical Lab	Credits
I	MSCS-L11	Python Lab	2
	MSCS-L12	Unix Administration Lab	2
II	MSCS-L21	Network Security & Malware Analysis Lab	2
	MSCS-L22	TCP/IP Lab	2
III	MSCS-L31	Cyber Forensic Lab	2
	MSCS-L32	Ethical Hacking Lab	2

Note: MTech (Cyber Security) consists of 3 audit courses. These courses do not weigh any credits but are must to pass for promoting to next semester. The percentage of a student would be calculated using credit courses only.

Semester I

Subject Code	Subject Name	(L)	(T)	(P)	Credits
MSCS-11	Fundamental of Mathematics	3	1	-	4
MSCS-12	Advance Concepts of Information Technology	3	1	-	4
MSCS-13	Cyber Crime and IT Law	3	1	-	4
MSCS-14	Elective I	3	1	-	4
MSCS-15	Language and Communication Skills (Audit Course)	2		-	-
MSCS-L11	Python Lab	-		4	2
MSCS-L12	Unix Administration Lab	-		4	2
	Total Credits				20

List of Electives:

- Intellectual Property Right in Digital Environment
- Disaster Management w.r.t. Cyber Security
- Social Networking w.r.t. Cyber Security

Paper Title: **Advanced Mathematics**

Course Credits: 4 (3-1-0) **MSCS-11**

Unit	Topic
I	Algebraic structures (definitions, examples and basic properties): Groups, Abelian and cyclic groups, subgroups, cosets, Lagrange's theorem, rings, subrings, ideals and quotient rings, integral domains, fields, reducible and irreducible polynomials, finite fields, construction of finite fields of small orders.
II	Vector spaces, subspaces, bases and dimensions, linear transformations, invertible linear transformations, matrix representations, inner product spaces, Gram-Schmidt orthogonalization process, eigenvalues and eigenvectors of matrices and linear operators, matrix-diagonalization, rank, singular values and singular value decomposition of matrices.
III	Divisibility, greatest common divisors, Euclidean algorithm, modular Arithmetic, prime numbers, congruences, quadratic residues, residue classes, Fermat's little theorem, Euler's totient function, Euler's theorem, Chinese remainder theorem.
IV	Basic concepts of codes: encoding and decoding processes, encoding functions, generation of codes using parity checks, Hamming distance, minimum distance, group codes, decoding functions, linear codes, Hadamard and Goppa codes.
V	Basic concepts of Probability: Random experiments, sample spaces, axiom's of probability, conditional probability, Baye's theorem, random variables, discrete and continuous random variables, probability mass and density functions, central limit theorem, introduction to random processes, Markov Chains.

Books recommended:

- D. S. Malik, J. Mordeson, M. K. Sen, Fundamentals of abstract algebra, Tata McGraw Hill, 1997
- 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

Paper Title: **Advance Concepts of Information Technology**

Course Credits: 4 (3-1-0) **MSCS-12**

Unit	Topics
I	Operating system overview, Process states, description, and control, Threads, multicore, multithreading
II	Overview of different Operating systems Windows 8, Linux versions, Solaris, iOS, Android. Working on different platforms
III	Security overview in different operating systems. File system in different operating systems
IV	Introduction to Real-Time Systems, Distributed operating systems, Embedded Systems, Reading: operating-system.org's "VxWorks", Reading: operating-system.org's "QNX"
V	Software and hardware differences between basic machine operating system and Palm OS.Case Study

Books recommended:

- V. Rajaraman, Fundamentals of Computers
- PROGRAMMING IN C – E BALAGURUSAMY
- E. Balaguruswamy, "Objected Oriented Programming with C++", TMH
- Herbert Schidlt , The complete reference Java , Seventh Edition , TataMcGraw Hill
- R. S. Pressman, "Software Engineering – A practitioner's approach", McGraw Hill Int. Ed.
- H.F. Korth and Silberschatz: Database Systems Concepts, McGraw Hill
- Tananbaum A.S., "Computer Networks", PHI.
- Stalling W, "Data & Computer Communications", PHI
- B. Forouzan, "Data Communication and Networking", Tata McGraw Hill
- Silbershatz and Galvin, " Operating System Concepts", Addison Wesley

Paper Title: **Cyber Crime, IT Law and Information System Management**

Course Credits: 4 (3-1-0) **MSCS-13**

Unit No.	Topics
Unit I	Understanding Cyber Crimes, Cyber Espionage, Cyber Warfare, Cyber Terrorism.
Unit II	IT Act, 2000 and IT (amendment) Act, 2008. CRPC overview, Case studies
Unit III	Four 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 - legal issues
Unit IV	Information Security, Risk Analysis & Management: Information Security: Asset, Threat, vulnerability, Countermeasure, Expected Loss and Impact.
Unit V	Risk Management: Risk Assessment, Risk Mitigation, Risk Evaluation and Discussion. Risk Analysis Terminology. Case studies

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 Crime: How to Protect Yourself from Computer Criminals, Laura E. Quarantiello
- 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.

Paper Title: **Intellectual Property Right in Digital Environment**

Course Credits: 4(3-1-0) **Elective** **MSCS-14**

Unit	Topics
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
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
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
IV	International and National Framework for Protection of IP and Agreements under WIPO, Primary legislations regulating IP in India
V	Valuation and Management of IP Assets, Concept of Monopoly and Perfect Competition, Valuation Methods, IP Management strategies, Concept of Audit, and Taxation

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 Jayashree Watal
- Intellectual Property: Valuation, Exploitation, and Infringement Damages by Russell L. Parr , Gordon V. Smith
- Intellectual Property Law in India by P.S. Narayana

M.Tech in Cyber Security

(SEMESTER –I)

Paper Title: Language & Communication Skills

Paper Code: MSCS-15

Course credits: 3 **Continuous Evaluation: 30 Marks**

Course duration: 40 Hours Max. Marks:100 **Semester End Examination: 70 Marks**

ENGLISH LANGUAGE & COMMUNICATION SKILLS

Objectives of the Course: -

1. Identify and appreciate the range of Communication including purpose and process.
2. Teach the students some of the techniques and nuances of written and oral communication.
3. Distinguish between Verbal and Non-Verbal Communication.
4. Identify and apply techniques which will improve personal communication skills.
5. Understand and demonstrate the use of basic and advanced writing techniques that today's technology demands, including anticipating audience reaction.
6. Interviews and Mock Interviews.
7. Develop interpersonal skills that contribute to effective and satisfying personal, social and professional relationships
8. Learn to comprehend text & passages.
9. Identify errors in the use of grammar and correct them.
10. Develop writing skills including Composition & Precis.

Teaching Learning Methodology :

1. Lecture Method
2. Group Discussion
3. Presentation
4. Role Play
5. Case Study

Evaluation Scheme:

1. End Term
2. Mid-Term
3. Continuous Assessment

ENGLISH LANGUAGE & COMMUNICATION SKILLS

COURSE CURRICULUM

UNIT I – Communication Introduction & Theory

- Communication – Definition and Process
- Verbal & Non Verbal Communication
- Barriers to Communication

UNIT II – Oral Communication skills

- Interpersonal Skills
- Features of a Good Presentation
- Group Discussion (No Question to be set for exams)
- Extempore (No Question to be set for exams)
- Interview – Types & Mock Interviews* (*No questions to be set from these topics)

UNIT III – Written Communication

- C V Writing
- Letters and Application Writing

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.
- Concord & Prepositions
- Phrasal Verbs & Idioms (from the list the provided)

UNIT V – Comprehension and Text (Stories/Essays/Poems)

- A Chameleon - Anton Chekhov
- The Kabuliwallah – Rabindranath Tagore
- On the Rule of the Road – A.G. Gardiner
- Selected Snobberies – Aldous Huxley
- Lochinvar – Walter Scott
- Granny's Tree Climbing – Ruskin Bond

References: -

Suitable texts are to be chosen by the instructors from text and references listed below as well as from other sources.

- Bond Ruskin – Collected Short Stories, Rupa & Co.
- Chekhov, Anton – Collected 201 stories, Eldritch Press
- Sinha K. Susanta – English Essayists Ed. OUP
- 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.
- Pushp Lata & Sanjay Kumar – Communication to Conquer. PHI Learning, 2010 (DVD included)
- Alian Stannard – Living English Structure, OUP
- Murphy Raymond – Intermediate English Grammar, Cambridge University Press,
- **(How to build a better vocabulary – Maxwell, Nurnbey, Morris, Roesmblom.
- Readymade C.V's – The Times
- Williams, Lynn – Ultimate Interviews
- Imam, S.T. – Brush up your English
- 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
- Eastwood John – Oxford Practice Grammar
- Murphy Raymond – English Grammar
- Michael Swan – Practical English Usage
- Wren and Martin – High school English Grammar and composition.
- Bolton David – English Grammar in steps
- Edward Thorpe – Objective English

** Publishers Names to be given

Semester II

Subject Code	Subject Name	(L)	(T)	(P)	Credits
MSCS-21	Mobile And Wirelesss Security	3	1	-	4
MSCS-22	TCP/IP and Network Security	3	1	-	4
MSCS-23	Applied Cryptoraphy	3	-	2	4
MSCS-24	Elective II	3	1	-	4
MSCS-25	Behavioural Science (Audit Course)	2		-	-
MSCS-L21	Network Security & Malware Analysis Lab	-		4	2
MSCS-L22	TCP/IP Lab	-		4	2
	Total Credits				20

List of Electives:

- Banking Technology Management
- Cyber Security Models

Paper Title: **Mobile And Wireless Security**

Course Credits: 4 (3-1-0) **MSCS-21**

Unit	Topics
I	Wireless Networking Trends, Key Wireless Physical Layer Concepts, Wireless Local Area Networks, Wireless Personal Area Networks, WiMAX (Physical layer, Media access control, Mobility and Networking)
II	Mobile IPv4, Mobile IPv6, TCP over Wireless Networks, Ad Hoc Networks - Issues and Routing, Wireless Sensor Networks, Wireless Mesh and Multi-Hop Relay Networks
III	3G and 4G Network, General Packet Radio Services (GPRS), Universal Mobile Telecommunication System (UMTS)
IV	Radio Frequency Identification (RFID), Introduction to LTE, Security Issues in Wireless Networks
V	E-Commerce, M-Commerce, Electronic payment systems, electronic cards, Secure Electronic Transactions: Trust, Encryption, Authentication, confidentiality, integrity, and non-repudiation

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, Lothar Merk, 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.

Paper Title: **TCP/IP and Network Security**

Course Credits: 4 (3-1-0) **MSCS-22**

Unit	Topics
I	TCP/IP: Working of DNS, HTTP, FTP and SMTP/POP. Configuration of DNS, Web, FTP and MailServer. Working of TCP, UDP, IP , ARP,ICMP. Security at Application Layer: PGP and S/MIMIE, E-mail security, PEM, Secure binding of multimedia streams
II	Security Problem in TCP/IP Protocol Suite: Identification of Security issues in ethernet, ARP, IP, TCP, Application and Routing protocols. Secure network infrastructure services: DNS, NTP, SNMP, SSL Architecture, SSL/TLS Basic Protocol, SSL Message Formats, Session Resumption.
III	Security at Network Layer Routing algorithm vulnerabilities: route and sequence number spoofing, instability and resonance effects. Information hiding: DMZ networks, route aggregation and segregation ICMP redirect hazard: denial of service.
IV	Firewalls: Network partitioning, firewall platforms, partitioning models and methods. Secure SNMP, Secure routing interoperability: virtual networks. Transparent and opaque network services. Source masking and hidden channels. IDS, Honeypots, Honey nets
V	Security Models: Military and civil security, vulnerability and threat models, End-end Security, link encryption, compartments Privacy. Authentication. Denial of service. Nonrepudiation. Issues in multi-level secure systems. Internet security models: IPv4/IPv6 encapsulation header

Books recommended:

- S. Tannenbaum.Computer Networks, 2nd Edition, Prentice-Hall, 1988.
- D. E. Comer. Internetworking with TCP-IP: Principles, Protocols and Architecture, Vol I, 2nd Edition, Prentice Hall, 1991.
- Tananbaum A.S., "Computer Networks", PHI.
- Stalling W, "Data & Computer Communications", PHI
- B. Forouzan, "Data Communication and Networking", Tata McGraw Hill
- Michael A. Miller, "Data & Network Communication", Vikas Publication
- TCP/IP Protocol Suite (McGraw-Hill Forouzan Networking) by Behrouz Forouzan

Paper Title: **Applied Cryptography**

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

Unit	Topics
I	Classical Encryption Techniques and their Cryptanalysis: Symmetric cipher model, Substitution techniques, Transposition techniques, Rotor machine, Steganography, One-Time Pad (Vernam's Cipher), Limitations of Perfect Secrecy, Shannon's Theorem.
II	Private-Key Encryption Schemes and Block Ciphers: Pseudorandom Functions and permutations, Private-Key Encryption Schemes from Pseudorandom Functions, DES – The Data Encryption Standard, Attacks on DES, Single-Round DES, Two-Round DES, Three-Round DES, Brute Force Search, Best Known Attacks on Full DES, Increasing the Key size for DES, Modes of Operation.
III	Public-Key (Asymmetric) Cryptography: Public-Key Problems and Mathematical Background, Diffie-Hellman Key Agreement, El-Gamal Encryption Scheme, RSA Encryption, Security of RSA, Hybrid Encryption , Attacks on RSA, Private and Public-Key Reversal, Common Modulus Attack, Simplified Broadcast Attack , Timing Attacks, Elliptic Curve Cryptography.
IV	Hash Functions: Definition and Properties, Constructions of Collision-Resistant Hash Functions, Popular Uses of Collision-Resistant Hash Functions, Random Oracle Model. Hash algorithms: MD5, SHA-256.
V	Key Distribution using Symmetric and Assymetric encryption, Distribution of Public Keys, Remote User Authentication, Kerberos

Books recommended:

- K. M. Martin, Everyday Cryptography, Oxford University Press (2012).
- N. Ferguson, B. Schneier and T. Kohno, Cryptography Engineering, Wiley (2010)

Paper Title: **Banking Technology Management**

Course Credits: 4 (3-1-0) *Elective* **MSCS-24**

Unit	Topics
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.
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.
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)
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.
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.

Paper Title: **Behavioral Sciences**

Course Credits: NA ***Audit Course*** **MSCS-25**

Unit	Topics
I	Social and Emotional Intelligence
II	Cognitive Science: Perception, Language, Memory, Reasoning, Emotion
III	Motivation: Types of theories and models, Intrinsic and Extrinsic Motivation, Psychological theories and models
IV	Social Neuro Science: Nervous System, Biological Mechanisms
V	Ethics

Books Recommended:

- Psychology by Baron. Pearson
- Emotional Intelligence by Daniel Goleman. Bloomsbury Publishing
- "Atkinson and Hilgard's Psychology: An Introduction" by Geoffrey Loftus, Willem and Barbara. Cengage
- "Psychology: The science of mind and behaviour" by Michael W Passer, Ronald. McGraw-Hill
- Fundamentals of Cognitive Psychology by Henry and Reed. Tata McGraw-Hill
- Biopsychology by John P J Pinel. Allyn & Bacon Publications

Semester III

Subject Code	Subject Name	(L)	(T)	(P)	Credits
MSCS-31	Cyber Forensics, Audit And Investigation	3	1	-	4
MSCS-32	Web Application Security	3	1	-	4
MSCS-33	Database Security	3	1	-	4
MSCS-34	Elective III	3	1	-	4
MSCS-35	Research Methodology (*Audit Course*)	2		-	-
MSCS-L31	Cyber Forensic Lab	-		4	2
MSCS-L32	Ethical Hacking Lab	-		4	2
	Total Credits				20

List of Electives:

- Security Analysis of Protocols
- Cloud Computing And Security
- Big Data & Analytics
- Case Study
- Network finger printing & Access control.
- Internet Architecture & 4GLs

Paper Title: **Cyber Forensic, Audit And Investigation**

Course Credits: 4 (3-1-0) **MSCS-31**

Unit	Topics
I	File systems, Microsoft file structure, Examining NTFS disks, Microsoft BitLocker, Third-Party Disk Encryption Tools, Windows Registry, Start-up Tasks, Virtual Machines, Macintosh file structure and boot process, UNIX and Linux disk structures and boot processes. Other Disk structures (CD, SCSI, IDE and SATA devices)
II	Commercial Forensic Tools (Encase, FTK), Advanced Features of forensic tools (search, encryption and decryption, data carving), windows registry, memory analysis, advanced file system analysis (deleted and hidden data, metadata, temporary file, unknown\executable file analysis), applied decryption.
III	Graphic files: recognition, lossless and lossy data compression, locating and recovering graphic files, Identifying unknown file formats.
IV	Virtual Machines, Network Forensics, Network tools, E-mail Investigation, E-mail forensics tools, Mobile Device Forensic.
V	Computer Investigation,Evidence acquisition, Processing crime and Incidence scene, Preserving, Analysis, Digital forensic investigation procedures, Report writing, Ethics

Books Recommended:

- 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 River Media
- Bunting, Steve and William Wei. EnCase Computer Forensics: The Official EnCE: EnCase Certifed 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 and Technology, Academic press
- Carrier, Brian. File System Forensic Analysis. Addison-Wesley Professional

Paper Title: **Web Application Security**

Course Credits: 4 (3-1-0) **MSCS-32**

Unit	Topics
I	Web Fundamentals – HTML, HTTP, Client-side scripting, Server-side scripting; Web server architecture - Windows & Linux, IIS and LAMP servers, Network topologies and DMZ,
II	Web applications: Introduction to web applications, Web application hacking, Overview of browsers, extensions, and platforms
III	Attacks, detection evasion techniques, and countermeasures for the most popular web platforms, including IIS, Apache, PHP, and ASP.NET Attacks and countermeasures for common web authentication mechanisms, including password-based, multifactor (e.g., CAPTCHA), and online authentication services like Windows Live ID.
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.
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

Paper Title: **Database Security**

Course Credits: 4 (3-1-0) **MSCS-33**

Unit	Topics
I	Introduction (Databases and Information Systems, An example usage context, Database system concepts and architecture), Overview of Information Security, Database design using the relational model :- Functional dependencies : Keys in a relational model, Concept of functional dependencies, Normal forms based on primary keys, BCNF Further Dependencies : Multi-values dependencies and fourth normal form, Join dependencies and fifth normal form, Inclusion dependencies, Other dependencies and normal forms
II	Database security lifecycle, data risk assessment, Analyze data threats, risks and vulnerabilities, Understand the need for a database security architecture, database security architecture, Implement a feedback mechanisms, Understand how to adjust policies and practices based on feedback mechanisms using different security models.
III	Database Vulnerabilities, Threats and Physical Security: distinction between data and database security from network and perimeter security, external and internal database threats, flaws in perimeter security, risks of not securing an organization's data, typical database security hierarchy, analysis general security landscape, evaluation of security fundamentals, Understand the importance for staying current with database releases, fixes and security patches , Managing USB ports and USB enabled devices, Understand the implications of the physical placement of database files and their copies
IV	Access control of relational databases, Temporal role-based access control in database management, Access control models for XML databases. Managing and Querying Encrypted Data, Security in Data Warehouses and OLAP Systems
V	Secure Semantic Web Services, Geospatial Database Security, Damage Quarantine and Recovery in Data Processing Systems, Privacy-enhanced Location-based Access Control, Efficiently Enforcing the Security and Privacy Policies in a Mobile Environment

Books recommended:

- Handbook of Database Security: Applications and Trends by Michael Gertz and Sushil Jajodia
- Database Security and Auditing, Hassan A. Afyouni, India Edition, CENGAGE Learning, 2009.
- Database Security, *Castano,* Second edition, Pearson Education
- Database security by alfred basta, melissa zgola, CENGAGE learning

Paper Title: **Research Methodology**

Course Credits: NA | ***Audit Course*** | **MSCS-35**

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

Paper Title: **Security Analysis of Protocols**

Course Credits: 4 (3-1-0) ***Elective*** **MSCS-34**

Unit	Topics
I	Introduction: Security protocols, Security properties, Public-key certificates and infrastructures, Cryptographic hash functions, Digital signatures, Security protocol vulnerabilities
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.
III	Protocol analysis tools
IV	CSP**:** Basic building blocks, Parallel operators, Process behaviour, Modelling security protocols in CSP - Trustworthy processes, Modelling an intruder, protocol goals.
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

Paper Title: **Cloud Computing And Security**

Course Credits: 4 (3-1-0) ***Elective*** **MSCS-34**

Unit	Topics
I	Overview of Computing Paradigm: Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing
II	Introduction to Cloud Computing: Cloud Computing (NIST Model): Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers. Properties, Characteristics & Disadvantages: Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing. Role of Open Standards
III	Cloud Computing Architecture: Service Models (XaaS), Deployment Models, Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), Resource Virtualization
IV	Service Management in Cloud Computing: Service Level Agreements (SLAs), Economics of scaling, Managing Data
V	Cloud Security: Infrastructure Security, Data security and Storage, Identity & Access Management, Access Control

Paper Title: **Big Data And Analytics**

Course Credits: 4 (3-1-0) ***Elective*** **MSCS-34**

Unit	Topics
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
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.
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.
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.
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

Semester IV

Subject Code	Subject Name	(L)	(P)	Credits
MSCS-41	Dissertation	-	-	20
	Total Credits			20

Paper Title: **Dissertation**

Course Credits: 20 (0-20-0) **MSCS-41**

This is the 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 (prior approval by the department). For this first part of 20 credits, periodic internal assessment shall be done by the department. At the end of semester, students would be required to submit dissertation report. The continuous evaluation would be based on periodic checkpoint presentations by the students. The end semester evaluation would be based on dissertation report and open seminar with an external examiner.