



School of Computer Science & IT Devi Ahilya Vishwavidyalaya

SYLLABUS

M.Sc (Integrated) Cyber Security 5 years

Program Educational Objectives (PEOs)

- PEO 1:** Acquire comprehensive knowledge in cybersecurity and develop global competence for pursuing higher education or taking up advanced research challenges.
- PEO 2:** Demonstrate technical, analytical, teamwork, and entrepreneurial skills to innovate and address global cybersecurity challenges.
- PEO 3:** Excel as a cybersecurity professional, not only to address challenging issues of cybercrime but also to create awareness in society about potential threats.

Program Specific Outcomes (PSOs)

- PSO 1:** Acquire knowledge of secure computing systems and networks, and apply that knowledge to design and implement robust security solutions.
- PSO 2:** Develop expertise in identifying, assessing, and mitigating cyber threats using modern tools, while adhering to ethical and legal standards in cybersecurity.

IV - SEMESTER

CS-2023: MICROCONTROLLERS AND EMBEDDED SYSTEMS

Course Outcomes (COs):

- CO1:** Understand the difference between a Microprocessor and a Microcontroller and embedded microcontrollers.
- CO2:** Familiarize the basic architecture of the 8051 microcontrollers.
- CO3:** Develop hardware/software co-design and firmware design approaches. 8051 Instruction Set and Program 8051 Microprocessor using Assembly Level Language and C.
- CO4:** Implement 8051 Instruction Set and Program using Assembly Level Language and C.
- CO5:** Interface 8051 to external memory and I/O devices using its I/O ports. Basics of serial communication and serial port programming.
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Course Contents

UNIT-I

No. of Hours: 8

Introduction to 8 bit microcontrollers; Basic differences and similarities between Microprocessor and Microcontroller. A brief History of 8051, 8052, 8031, AT89651. 8051.Types of architectures: Harvard and von Neumann, RISC and CISC.

UNIT-II

No. of Hours: 8

Introduction to 8051 Microcontroller : Intel 8051 history, Pin diagram of 8051, 8051- architecture, Registers, Timers Counters, Flags, Special Function Registers, DPTR, PC, PSW, SP etc. , I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.

UNIT-III

No. of Hours: 8

8051 Instruction Set: Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions.

UNIT-IV

No. of Hours: 8

Configuration and Programming of Timer/Counter using Special Function Registers [SFRs]: TMOD, TCON, THx, TLx, Simple programs to generate the time delays. interrupt programming, Types of interrupt, Configuration and Programming of interrupts using SFRs: IE, IP.

UNIT-V

No. of Hours: 8

8051 Serial Communication- Basics of Serial Data Communication, RS232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially. Interfacing simple switch and LED to I/O ports to switch on/off LED with respect to switch status.

Text Books:

1. "The 8051 Microcontroller and Embedded Systems – using assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006.
2. "The 8051 Microcontroller", Kenneth J. Ayala, 3rd Edition, Thomson/Cengage Learning.

Reference Books:

1. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education, 2005
2. "The 8051 Microcontroller Based Embedded Systems", Manish K Patel, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
3. Programming and Customizing the 8051 Microcontroller, Predko; TMH.

Online Resources:

CS-3630: CYBER CRIMES AND CYBER LAWS

Course Outcomes (COs):

- CO1:** Explain core concepts of cybercrimes, cyber law, and digital rights.
- CO2:** Identify and classify major cyber offenses and defenses with real examples.
- CO3:** Interpret key provisions of the IT Act 2000/2008, BNS, BNSS, and BSA (2023).
- CO4:** Analyze case studies to outline investigation steps, digital evidence handling, and prosecution.
- CO5:** Apply legal, ethical, and privacy principles to recommend compliant cyber practices.
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Course Contents

UNIT-I

No. of Hours: 6

Introduction to Cyber Crime and Legal Evolution: Introduction to cyber crime and its evolution: definition, nature, and illustrative cases. Need and importance of cyber law in the digital ecosystem. History and development of IT legislation in India. Introduction to legal reforms—Bharatiya Nyaya Sanhita (BNS), Bharatiya Nagarik Suraksha Sanhita (BNSS), and Bharatiya Sakshya Adhinyam (BSA), 2023.

UNIT-II

No. of Hours: 6

Types and techniques of cybercrimes: hacking and unauthorized access, phishing and social engineering, identity theft, cyberstalking, cyberbullying, malware and ransomware, financial frauds, intellectual property violations, cyber terrorism, and data breaches. Emerging crime patterns: deepfake-enabled deception and digital arrest scams. Preventive security mechanisms: cyber hygiene, authentication, access control, safe browsing, and incident reporting. Role of intermediaries and service providers: due diligence and liability.

UNIT-III

No. of Hours: 6

Legal Framework and Provisions under Indian Cyber Law: Legal framework under Indian cyber law: Information Technology Act, 2000 and IT (Amendment) Act, 2008—digital signatures, e-governance, cyber contraventions, offences, and penalties. Relevant provisions of Bharatiya Nyaya Sanhita (BNS), 2023 relating to cyber-enabled offences. Cybercrime adjudication and appellate mechanisms. Institutional framework: roles and functions of CERT-In, Controller of Certifying Authorities (CCA), and cyber appellate authorities.

UNIT-IV

No. of Hours: 6

Cybercrime Investigation and Forensic Procedures: Cybercrime investigation process: registration, inquiry, search and seizure, analysis, documentation, and prosecution support. Digital evidence collection, preservation, and presentation as per Bharatiya Sakshya Adhinyam (BSA), 2023, including admissibility and chain of custody. Jurisdictional challenges and inter-agency coordination under Bharatiya Nagarik Suraksha Sanhita (BNSS), 2023. Cyber forensic tools and e-discovery workflow. Role of police, cyber cells, forensic experts, and judiciary.

UNIT-V**No. of Hours: 6**

Cyber ethics and responsible online behavior: ethical hacking boundaries, professional conduct, and responsible disclosure. Digital privacy and data protection principles and laws in India. Contemporary challenges: AI-generated crimes, deepfake misuse and governance concerns, cryptocurrency frauds, online defamation, and social media misuse. Global legal frameworks and comparative study: Budapest Convention, GDPR, and cross-border cyber law issues.

Text Books:

1. Cyber Laws- Justice Yatindra Singh, Universal Law Publishing Co., 3rd Edition, 2016.
2. Cyber Law Simplified- Vivek Sood, Tata McGraw Hill Education, 2nd Edition, 2013.

Reference Books:

1. Information Technology Law and Practice- Vakul Sharma, Universal Law Publishing Co., 3rd Edition, 2017.
2. Cyber Crime and Digital Evidence: Materials and Cases- Shashank Ghosh, Cambridge University Press, 1st Edition, 2019.
3. Information Security and Cyber Laws- Dhiraj R., PHI Learning Pvt. Ltd., 2nd Edition, 2018.

Online Resources:

1. https://onlinecourses.swayam2.ac.in/cec25_cs04/preview
2. <https://cybercrime.gov.in/Webform/CrimeCatDes.aspx>

CS-4116: DISCRETE STRUCTURES

Course Outcomes (COs):

- CO1:** Understand the basic concepts of set, function and mathematical reasoning.
- CO2:** Exposure to various counting techniques and its applications in computer science.
- CO3:** Develop an understanding about relations & its property and lattices.
- CO4:** Apply the concepts of graph and tree in different applications.
- CO5:** Get acquainted with the language and grammar.
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Course Contents

UNIT-I

No. of Hours: 8

The Foundations: Logic, Sets and Functions: Introduction to set theory, set operations, fuzzy sets, mathematical logic, prepositions, propositional equivalences, predicates and quantifiers. Importance of Quantifiers. Functions, types of functions, Inverse function and composite functions. Mathematical reasoning: Introduction to Methods of proof, mathematical induction. Use of mathematical induction to solve different problems. Importance of recursions in computer science, scope of recursions, Recursive definitions, recursive algorithms.

UNIT-II

No. of Hours: 8

Combinatorics: The basics of counting, sum rule, product rule, pigeonhole principle, permutations with repetitions, permutations without repetitions, circular permutations. Applications of combinations. Applications of combinatorics to solve committee problems, word problems, puzzle problems etc. Applications of combinatorics to understand telephone numbering plan, understanding Internet addresses, advanced counting techniques, recurrence relations, solving recurrence relations, algorithm design, basic understanding of complexities, basic problems of complexity of algorithms.

UNIT-III

No. of Hours: 8

Relations: Relation definition, importance of relations in computer science, Relations and their properties, Unary relations, Binary relations, Ternary relations, n-ary relations and their applications, closures of relations, equivalence relations, partial ordering. Representing relations, relation matrix, relation graph, composite relation. Operations on relations – union, intersection and join. Concepts of least upper bound, Greatest lower bound, maximal element, minimal element, Greatest element, Least element of a partially ordered set, lattices.

UNIT-IV

No. of Hours: 8

Graphs: Introduction to graphs, importance of graph theory in computer science, graph terminology, representing graphs, graph types, graph models, and graph isomorphism. connectivity, Euler and Hamiltonian Paths, shortest path problems, planar graphs, graph coloring, chromatic number, Euler's formula, Kuratowski's theorem. The four color problem, applications of Graph

Coloring, introduction to Trees, applications of trees, tree traversal, trees and sorting, Spanning trees, minimum spanning trees.

UNIT-V

No. of Hours: 8

Languages and Grammars: Introduction to Languages and Grammars, solving problems for validity of statements according to the grammar. Importance of Language theory in Computer Science, importance of derivation trees, solving problems of derivation trees, importance of parsing, Phrase-Structure Grammars, types of Phrase-Structure Grammars.

Text Books:

1. Discrete Mathematics and its Applications-Kenneth H. Rosen, 8th Edition, Tata McGraw Hill, 2021.
2. Elements of Discrete Mathematics: A Computer Oriented Approach- C Liu, D. Mohapatra, 4th Edition, 2017.

Reference Books:

1. Discrete Mathematical Structures-Kolman, Busby & Ross, 6th Edition, Pearson Education, 2015.
2. Graph Theory with Applications to Engineering and Computer Science-Narsingh Deo, 4th Edition, 1979.
3. Discrete and Combinatorial Mathematics-Ralph P. Grimaldi, 5th Edition, Addison-Wesley Publications, 2019.

Online Resources:

1. <https://ocw.mit.edu/courses/6-042j-mathematics-for-computer-science-fall-2010/>
2. https://onlinecourses.nptel.ac.in/noc22_cs123/preview
3. <https://www.geeksforgeeks.org/engineering-mathematics/discrete-mathematics-tutorial/>
4. <https://www.udemy.com/course/discrete-math/>

CS-4524: LINUX ESSENTIALS FOR CYBER SECURITY

Course Outcomes (COs):

- CO1:** Understand Linux architecture, file systems, and basic administration tasks.
- CO2:** Operate effectively on the Linux command line for system and security tasks.
- CO3:** Use shell scripting for automation and cybersecurity operations.
- CO4:** Apply Linux networking and user management for secure environments.
- CO5:** Configure, audit, and harden Linux systems against cyber threats using Kali Linux tools.
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Course Contents

- UNIT-I** **No. of Hours: 6**
Linux Fundamentals & Architecture: Introduction to Linux and Open Source Philosophy, Linux Distributions and File Hierarchy, Structure, Linux Boot Process and System Initialization, Basic Shell and Terminal Operations, File and Directory Management (ls, cp, mv, rm, chmod, chown, ln), Understanding File Permissions and Ownership, Package Management (apt, yum, dnf).
- UNIT-II** **No. of Hours: 6**
Command-Line Mastery & Shell Scripting: Essential Commands for Cybersecurity Experts, Environment Variables and Shell Configuration Files, Bash Shell Scripting Fundamentals, Conditional Statements and Loops, Functions and Script Parameters, Writing Automation Scripts for Log Monitoring, Backup, and System Tasks, Cron Jobs and Task Scheduling.
- UNIT-III** **No. of Hours: 6**
User, File, and Process Management for Security: User and Group Administration (useradd, passwd, groupmod, sudoers), File Permissions, ACLs, and Secure Access Controls, Process Monitoring and Management (ps, top, kill, nice, renice), Resource Monitoring (df, du, free, vmstat, iostat), Log Management (rsyslog, journalctl, /var/log), Securing the Linux File System, Configuring and Managing Firewalls (ufw, iptables basics).
- UNIT-IV** **No. of Hours: 6**
Networking and System Security in Linux: Linux Networking Fundamentals (ifconfig, ip, netstat, ss, ping, traceroute), Network Configuration and Troubleshooting, Secure Shell (SSH) Configuration and Key-based Authentication, Configuring Firewalls with iptables and ufw, Intrusion Detection Concepts (auditd, fail2ban) System Hardening Techniques, Introduction to Linux Security Modules (SELinux, AppArmor).
- UNIT-V** **No. of Hours: 6**
Linux for Ethical Hacking and Security Operations: Introduction to Kali Linux and Security-Focused Distributions, File Integrity and Log Auditing Tools, Linux Command-Line Tools for Reconnaissance (nmap, netcat, tcpdump), Password Auditing and User Security (John the Ripper, Hydra), Privilege

Escalation Techniques and Mitigation, Forensics Basics using Linux Tools, Hardening Linux for Penetration Testing Environments.

Text Books:

1. Linux: The Complete Reference, McGraw-Hill Education, Richard Petersen, 6th Edition, 2022.
2. The Linux Command Line: A Complete Introduction, William E. Shotts, Jr. No Starch Press, 2nd Edition, 2019.
3. Linux Basics for Hackers: Getting Started with Networking, Scripting, and Security in Kali, OccupyTheWeb, No Starch Press, 2018.

Reference Books:

1. Linux Command Line and Shell Scripting Bible, Christine Bresnahan & Richard Blum, Wiley, 4th Edition, 2021.
2. Linux Firewalls: Attack Detection and Response with iptables, psad, and fwsnort, Michael Rash, No Starch Press, 2017.
3. LPIC-1: Linux Professional Institute Certification Study Guide, Roderick W. Smith, Wiley, 5th Edition, 2022.

Online Resources:

1. <https://training.linuxfoundation.org/resources/>
2. <https://www.kali.org/docs/>
3. <https://help.ubuntu.com/>

CS-4524: LINUX ESSENTIALS FOR CYBER SECURITY- PRACTICAL

Course Outcomes (COs):

CO1: Understand the principles and concepts of computer forensics.

CO2: Develop skills in conducting computer investigations using a systematic approach.

CO3: Gain proficiency in acquiring and preserving digital evidence from different storage formats.

CO4: Explore the use of specialized tools and software for computer forensics analysis.

CO5: Analyze techniques for investigating network-related incidents and conducting live acquisitions.

Course Contents

UNIT-I

No. of Hours: 8

1. Create a Forensic Image using FTK Imager/Encase Imager (Creating Forensic Image, Check Integrity of Data, Analyze Forensic Image).
2. Perform data acquisition using USB Write Blocker + Encase Imager, SATA Write Blocker + Encase Imager, Falcon Imaging Device.
3. Analyze the memory dump of a running computer system (Extract volatile data, such as open processes, network connections, and registry information).

UNIT-II

No. of Hours: 8

1. Recovering and Inspecting deleted files (Check for Deleted Files, Recover the Deleted Files, Analyzing and Inspecting the recovered files, Perform this using recovery option in EnCase and also Perform manually through Command line).
2. Demonstrate restoring of Evidence Image using EnCase Forensics.
3. Monitoring Activity Log (Last activity of Your PC).
4. Find Last Connected USB on your system (USB Forensics).

UNIT-III

No. of Hours: 8

1. Capturing and analyzing network packets using Wireshark (Identification the live network, Capture Packets, Analyze the captured packets).
2. Using Sysinternals tools for Network Tracking and Process Monitoring (Check Sysinternals tools, Monitor Live Processes, Capture RAM, Capture TCP/UDP packets, Monitor Hard Disk,. Monitor Virtual Memory, Monitor Cache Memory).

UNIT-IV

No. of Hours: 8

1. Demonstration of Steganography (Detect hidden information or files within digital images using steganography analysis tools, Extract and examine the hidden content).
2. Email Forensics (Analyze email headers and content to trace the origin of suspicious emails, Identify potential email forgeries or tampering).

UNIT-V**No. of Hours: 8**

1. Perform forensic analysis for mobile device, such as a smartphone or tablet, Retrieve call logs, text messages, and other relevant data for investigative purposes (Mobile device forensics).
2. Analyze browser artifacts, including history files, bookmarks, and download records, Analyze cache and cookies data to reconstruct user-browsing history and identify visited websites or online activities (Web Browser Forensics).
3. Extract the relevant log or timestamp file, analyze its contents and interpret the timestamp data to determine the user's last internet activity and associated details.

Text Books:

1. Linux: The Complete Reference, McGraw-Hill Education, Richard Petersen, 6th Edition, 2022.
2. The Linux Command Line: A Complete Introduction, William E. Shotts, Jr. No Starch Press, 2nd Edition, 2019.
3. Linux Basics for Hackers: Getting Started with Networking, Scripting, and Security in Kali, OccupyTheWeb, No Starch Press, 2018.

Reference Books:

1. Linux Command Line and Shell Scripting Bible, Christine Bresnahan & Richard Blum, Wiley, 4th Edition, 2021.
2. Linux Firewalls: Attack Detection and Response with iptables, psad, and fwsnort, Michael Rash, No Starch Press, 2017.
3. LPIC-1: Linux Professional Institute Certification Study Guide, Roderick W. Smith, Wiley, 5th Edition, 2022.

Online Resources:

1. <https://training.linuxfoundation.org/resources/>
2. <https://www.kali.org/docs/>
3. <https://help.ubuntu.com/>

CS-4644: DATA COMMUNICATION AND NETWORKS

Course Outcomes (COs):

CO1: Learn the basic concepts of data communication, computer networks, and the Internet.

CO2: Develop the problem-solving skills required for communication between devices by understanding the design issues and services of various layers in a network architecture.

CO3: Identify the different types of network devices and their function within a network.

CO4: Apply the knowledge in developing robust and secure IT applications.

CO5:

Course Contents

UNIT-I

No. of Hours: 8

Introduction: Data Communication, Networking, the Internet, Applications of Computer Networks; Design issues for the layers, OSI model, TCP/IP protocol architecture, OSI and TCP/IP, comparison; Data communication fundamentals – Signal, bandwidth, data rate, modulation; Channel capacity, Data and signals- Analog and Digital, Transmission impairment; Digital transmission- Digital to Digital conversion, Analog to Digital conversion; Digital transmission- Digital to Analog conversion, Analog to Analog conversion; multiplexing.

UNIT-II

No. of Hours: 8

Network Hardware – LAN, MAN, WAN and topologies Guided Transmission media – Twisted pair, Coaxial Cable, and Fibre Optics; Wireless transmission – Radio transmission, Microwave transmission, Infrared transmission. LAN components – File server, Workstations, Network Adapter Cards; Network Software - Protocol hierarchies, Connection-Oriented and Connectionless services, Service primitives, Relationship between Services and Protocols; Switching Techniques – Circuit Switching and Packet Switching.

UNIT-III

No. of Hours: 8

Design issues – Services, Framing, Error Control and Flow Control; Error Detection Techniques – Parity Check and Cyclic Redundancy Check (CRC); Error Correction Technique – Hamming code; Elementary Data Link Protocols – Unrestricted Simplex Protocol, Simplex Stop-and-Wait Protocol, Sliding Window protocols - One-Bit Sliding Window Protocol, protocol using Go Back N and Selective Repeat; Data link layer in the Internet – PPP, Frame relay, X.25 Networks.

UNIT-IV

No. of Hours: 8

Routing algorithms - Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing; Internetworking; The Network Layer in the Internet - Internet Protocol -IPv4 and IPv6, Internet addressing and Internet Control protocols-ICMP, ARP, RARP, DHCP, OSPF, BGP.

UNIT-V**No. of Hours: 8**

Transport Service, Elements of transport protocols - Addressing, Connection establishment, Connection release, Flow control, and Buffering, Multiplexing; The Internet Transport Protocols - UDP and TCP- services and applications. Client Server Architecture, DNS, WWW and HTTP, E-mail Protocols -SMTP, POP3, IMAP, MIME; FTP, TELNET.

Text Books:

1. Behrouz A. Forouzan, "Data Communications and Networking", Fifth Edition, McGraw-Hill Publication, 2013.
2. Andrew S. Tanenbaum, "Computer Networks", Fifth Edition, Pearson Education.

Reference Books:

1. William Stallings, "Data and Computer Communications", Eighth Edition, Pearson Education
2. James F. Kurose & Keith W. Rose "Computer Networking: A Top-Down Approach", Fourth Edition, Pearson Education.
3. Douglas E. Comer, "Computer Networks and Internets", Fourth Edition, Pearson Education.

Online Resources:

Computer Networks and Internet Protocol by Prof. Soumya Kanti Ghosh, Prof. Sandip Chakraborty, IIT Kharagpur, available at : https://onlinecourses.nptel.ac.in/noc25_cs15/preview

IC-2935: PROFESSIONAL ETHICS AND VALUES

Course Outcomes (COs):

CO1: Understand the importance of ethical behaviour.

CO2: Expose the students to the ethical practices to be followed in business.

CO3: Sensitize the students to become responsible persons who will uphold ethics in business when they pursue their career.

CO4: To make the students understand the ethical practices towards consumers and other stakeholders of business.

CO5: Identify ethical concerns in research and intellectual contexts, including academic integrity, use, and citation of sources.

Course Contents

UNIT-I

No. of Hours: 4

Human Values: Moral, Values, Ethics, Virtues and Vices, Work Ethics, Virtues and Vices, Respect for Others, Living Peacefully, Caring, Sharing, Honesty, Courage, Valuing Time, Cooperation, Commitment, Empathy, Self-confidence, Spirituality.

UNIT-II

No. of Hours: 4

Corporate Ethics: Ethics in the Business World, Corporate Social Responsibility, Why Fostering Corporate Social Responsibility and Good Business Ethics Is Important? How Organizations Can Improve Their Ethics, Including Ethical Considerations in Decision Making, Ethics in Information Technology.

UNIT-III

No. of Hours: 4

Ethics for IT Workers and IT Users: IT Worker Relationships That Must Be Managed, Encouraging the Professionalism of IT Workers, What Can Be Done to Encourage the Ethical Use of IT Resources Among Users?

UNIT-IV

No. of Hours: 4

Cyberattacks and Cybersecurity: Why Computer Incidents Are So Prevalent? Types of Exploits, Federal Laws for Prosecuting Computer Attacks, The CIA Security Triad, Response to Cyberattack.

UNIT-V

No. of Hours: 4

Privacy: Privacy Protection and the Law, Key Privacy and Anonymity Issues.

Intellectual Property: What Is Intellectual Property? Copyrights and Patents, Trade Secrets, Current Intellectual Property Issues.

The Impact of Information Technology on Society: The Impact of IT on the Standard of Living and Worker Productivity, IT and Workplace Automation, The Impact of IT on Health Care.

Social Media: Business Applications of Social Media, Social Networking Ethical Issues.

Text Books:

1. "Ethics in Information Technology", George W. Reynolds; Cengage, 2019.
2. "Professional Ethics and Human Values", R. S. Naagarazan, New Age International Punlisher, 2006.

Reference Books:

1. "Human Values and Professional Ethics", R. R. Gaur, R. Sangal, G. P. Bagaria, Excel Books, 2009.

Online Resources: