CSCI 347: Network Security and Digital Forensics

(draft Version: 2, Revision Date: 7/25/2025)

Fall 2025

Course Description:

This course provides students with integrated knowledge of network security fundamentals and digital forensics investigation techniques using exclusively free, open-source tools and emulated environments. Students begin with preventive security measures including cryptography, authentication, and network defense, then transition to reactive forensic analysis and incident response. The course emphasizes hands-on learning, peer collaboration, and real-world application using industry-standard tools.

Course Essentials:

Instructor: ---

- (email, Teams, chat)
- --- --- ----
- Office: ---
- Office Hours (virtual / face-to-face)

  T/Th

  W

  By arrangement (bookings)

- Class Location: Fully Online (self-paced)
- Course Updates:

  Canvas announcement (for changes to assignments, syllabus, etc.)

  MCLA Email: for school-related communication

Student Learning Outcomes:

Upon successful completion of this course, students will be able to:

1. **Implement and configure cryptographic systems** for secure communications using industry-standard protocols
2. **Design and deploy network security architectures** with layered defenses using enterprise-grade tools
3. **Configure enterprise firewalls, IDS/IPS, and authentication systems** using free, open-source platforms
4. **Investigate security incidents** using comprehensive digital forensic methodologies and legal frameworks
5. **Analyze digital evidence** across multiple platforms including Windows, Linux, macOS, and emulated mobile environments
6. **Integrate preventive security measures** with forensic readiness planning and incident response procedures
7. **Automate security and forensic processes** using Python scripting and professional frameworks
8. **Prepare professional forensic reports** and expert testimony materials meeting legal standards
9. **Contribute to open-source security projects** and collaborate effectively in professional cybersecurity communities

Course Materials

Texts and Resources

Required (shop around, don't pay full price):

- Stallings and Brown (2018) Computer Security: Principles and Practice, Global Edition, 4e ISBN 9781292220611 (international edition is cheaper!)
- NIST Special Publications - Core standards (SP 800-53, 800-86, 800-101, 800-61)
- Tool Documentation (official guides for course tools (pfSense, Volatility, Autopsy, Wireshark)
- Python Documentation (Standard Library and security-related modules)
- Legal Framework – Federal Rules of Evidence (Rule 702), basic digital evidence Guidelines

Technology Requirements

Minimum System Specifications:

- RAM: 8GB (16GB recommended for memory analysis)
- Storage: 100GB available disk space (200GB recommended)
- Processor: Dual-core with virtualization support (quad-core recommended)
- Network: Broadband internet connection for downloads and collaboration

Required Software (All Free):

- VirtualBox for virtualization and isolated testing environments
- Python 3.11+ with pip package manager for automation development
- Git for version control and collaborative development
- Modern web browser for web-based tools and documentation access

Supported Operating Systems:

- Windows 10/11 with Windows Subsystem for Linux (WSL2)
- macOS 10.15+ with Homebrew package manager
- Linux (Ubuntu 20.04+, CentOS 8+, Fedora 33+) with native package management

AI Policy:

- AI Tools Permitted: ChatGPT, Claude, and similar tools may be used for learning assistance
- Transparency Required: Document AI assistance in assignment submissions
- Understanding Focus: Emphasis on comprehension rather than just obtaining answers
- Code Verification: All AI-generated code must be tested, understood, and validated
- **AI use is not permitted during exams**. All exams must be taken in person.

Professional Ethics Framework

- Responsible Disclosure: Vulnerabilities discovered during coursework must be reported appropriately
- Legal Compliance: All security testing must be conducted in isolated, authorized environments
- Community Standards: Professional conduct expected in all online forums and peer interactions
- Continuous Learning: Commitment to ongoing professional development and ethical practice

Attendance Policy:

Students are expected to attend all of their classes. As a fully online, self-paced course, this mean that you are expected to maintain the submission deadlines (there's a lot of stuff that we are covering!). They must be aware of course requirements. In the event

of planned absences, students must notify their instructors as soon as possible. Students who expect to be absent from classes for mor than a week should contact Academic Advising & Support (advising@mcla.edu) for help notifying their instructor.

A. Excused Absences

A.1 Definition of Excused Absence

Any student, who is unable, because of the reasons identified in sections A.2.1 through A.2.4 of this policy, to attend classes or to participate in any examination, study, or work requirement on a particular day shall be excused from any such examination or study or work requirement on that day. The student shall be provided with an opportunity to make up such examination, study, or work requirement, which they may have missed because of such absence on any particular day, if such makeup examination or work shall not be deemed unreasonable by the faculty or the College. To take advantage of the opportunity to make up a missed examination, study, or work requirement, the student must contact their professor/faculty member to initiate this process.

When a student misses a major course assessment or assignment (including, but not limited to, lecture exams, laboratory sessions & exams, class performances, presentations, etc.) due to absence because of the reasons listed in section A.2.1 through A.2.4 of this policy, such makeup assignments may be unreasonable for the faculty member. It is within the discretion of the faculty member to determine what is deemed unreasonable in these situations.

No fees of any kind shall be charged by the College for making available to the student the opportunity to make up work resulting from an excused absence. No adverse or prejudicial effects shall result to any student because of availing themselves of the provisions of this policy.

A.2 Acceptable Excuses

Excused absences shall be granted for the following:

1. General student well being, which may include health, mental health, disability-related absences, and/or absence resulting from other extenuating circumstances. Students must inform the faculty member of their absence and request the opportunity to make up missed work according to the excused absence definition listed in section A.1. If absences total more than the following limits, it will be up to the discretion of the faculty member to allow the absence to be excused.
    - For classes meeting three times per week, a student may miss up to three class sessions during the semester.
    - For classes meeting two times per week, a student may miss up to two class sessions during the semester.
    - For classes meeting one time per week, a student may miss up to one class session during the semester.

If a class meets less than once per week, it will be at the discretion of the faculty member whether the student may be granted an excused absence.

Students with documented disabilities who request additional time for absence should also contact the Disability Resources Office for help notifying their instructors. If an instructor has concerns or feels unqualified to make a judgment about a student's absence, the Dean of Academic Affairs will make a determination in consultation with student support leadership.

2. Participation as a representative of the College in a scheduled intercollegiate athletic event. It will be the responsibility of the athletic department to notify instructors of the student's participation and absence in advance of the anticipated absence.
3. Participation as a representative of the College in a scheduled intercollegiate club competition or professional/academic conferences, travel courses, or field trips scheduled as part of a course. The club must be a recognized campus club. It will be the responsibility of the club advisor or the sponsoring academic/administrative department to notify the student's instructors of the student's participation and absence in advance of such absence.
4. Any student of the College who is unable, because of his or her religious beliefs, to attend classes or to participate in any examination, study, or work requirement shall be granted an excused absence, and shall be provided with an opportunity to make up missed work, provided that it shall not create an unreasonable burden upon the College. This requirement comes from the Commonwealth of Massachusetts General Law Chapter 151C, Section 2B which states: "Any student in an educational or vocational training institution, other than a religious or denominational educational or vocational training institution, who is unable, because of his religious beliefs, to attend classes or to participate in any examination, study, or work requirement on a particular day shall be excused from any such examination or study or work requirement, and shall be provided with an opportunity to make up such examination, study, or work requirement which he may have missed because of such absence on any particular day; provided, however, that such makeup examination or work shall not create an unreasonable burden upon such school. No fees of any kind shall be charged by the institution for making available to the said student such opportunity. No adverse or prejudicial effects shall result
to any student because of his availing himself of the provisions of this section."

B. Student Appeals

If a student believes their grade has been incorrectly penalized as a result of an absence, they may pursue an appeal through the college's existing undergraduate grade appeal policy.

See the full policy: lnk.mcla.edu/attendance

Grading Policy

Activities

At all times during the semester you will have access to your grade as well as details about how it is calculated. This information is available via Canvas. To view your grade, just click on the Grades tab on the left-hand side of the Canvas course page. If you have any questions about the grading policies listed here, please feel free to discuss them with me. The earlier you discuss your concerns with me, the better.

There will be no extra credit in this course. Students who wish to receive an A in this class must work very hard and develop an excellent understanding of the material. An A represents a near-perfect semester, which can be hard to accomplish.

Evaluation Criteria

Technical Assignments (55%)

Python Automation Projects (30%)

Final Capstone Project 15%

Final grades are based on the grading scale:

A	**A-**	**B+**	**B**	**B-**	**C+**	**C**	**C-**	**D+**	**D**	**F**
93-100	90-92	87-89	83-86	80-82	77-79	73-76	70-72	67-69	60-66	less than 60

Exams (50%)

Technical Assignments (55% of final grade):

- Weekly hands-on laboratory implementations
- Self-assessment using provided rubrics
- Peer review and collaborative problem-solving
- Automated testing and validation where applicable

Python Automation Projects (30% of final grade):

- Three major scripting projects throughout the course
- Progressive complexity building security/forensics toolkit
- Code quality, documentation, and testing emphasis
- GitHub repository maintenance and version control

Final Capstone Project (15% of final grade): Choose one focused project:

- **Security Tool Development:** Custom automation tool for security/forensics tasks
- **Forensics Case Study:** Complete investigation with professional documentation
- **Integration Project:** Security architecture with forensic readiness planning
- **Research Project:** Investigation of emerging security/forensics technique

Capstone Project Deliverables:

- **GitHub Repository** with comprehensive documentation
- **Technical Report** (10-15 pages) with analysis and findings
- **Video Demonstration** (5-10 minutes) of key functionality
- **Presentation** (10 minutes) with peer Q&A session

Late Assignment Policy

Standard Assignments:

- **24 hours late:** 10% penalty
- **48 hours late:** 20% penalty
- **72 hours late:** 30% penalty
- **Beyond 72 hours:** Assignment not accepted without prior arrangement

Major Projects and Capstone:

- **Extensions available** with 48-hour advance notice and valid justification
- **Emergency situations:** Contact instructor immediately for alternative arrangements
- **No penalty** for documented emergencies, illness, or family situations

Criteria for incomplete grades:

- The student is passing the course with a minimum grade of a C.
- The student has followed the attendance policy.
- The student meets with the instructor to discuss the terms of the incomplete contract.

Academic Honesty Policy

MCLA's Policy on Academic Honesty

Source: lnk.mcla.edu/honesty

A college is a community of students and faculty interested in the search for knowledge and understanding. Essential to that search is a commitment to honesty and integrity. Honesty on the part of every college student has and always shall be an integral part of the plan of higher education at Massachusetts College of Liberal Arts. Acts of dishonesty conflict with the work and purpose of the entire College and are not merely a private matter between student and instructor.

Violations of academic honesty include but are not limited to:

- Submitting the work of others as one's own
- Plagiarism (as defined below)
- Communication during an examination
- Using crib notes in an exam, except as allowed by the instructor
- Obtaining prior knowledge of examination questions
- Substitution of another student in an examination
- Altering College academic records
- Knowingly using false statements for academic benefit
- Collaborating on material after being directed not to collaborate
- Forging a signature of a College official or faculty member
- Soliciting an official signature under false pretense

Plagiarism - The academic departments of the College have varying requirements for reporting the use of sources, but certain fundamental principles for the acknowledgment of sources apply to all fields and levels of work. The use of source materials of any kind and the preparation of essays or laboratory reports must be fully and properly acknowledged. In papers or laboratory reports, students are expected to acknowledge any expression or idea that is not their own. Students submitting papers are implying that the form and content of the essays or reports, in whole and in part, represent their own work, except where clear and specific reference is made to other sources. Even if there is no conscious intention to deceive, the failure to make appropriate acknowledgment may constitute plagiarism. Any quotation - even of a phrase - must be placed in quotation marks and the precise source stated in a note or in the text; any material that is paraphrased or summarized and any ideas that are borrowed must be specifically acknowledged. A thorough reordering or rearrangement of an author's text does not release the student from these responsibilities. All sources that have been consulted in the preparation of the essay or report should be listed in the bibliography.

Upon an occurrence of alleged academic dishonesty instructors may exercise **their discretion in imposing a sanction**. Instructors may **further** file charges with the Academic Appeals Committee against students if they believe that additional sanctions would be appropriate. Instructors shall notify the Registrar in writing of any occurrence of academic dishonesty whenever they have imposed sanctions. Such notification shall include the student's name, course title, date of occurrence, type of dishonesty, sanction(s) being imposed, **and any further action requested**. This notification shall be effected within fourteen days after discovery of the incident. A copy of said notice shall be sent to the student involved, including the charges made against the student and the grounds, if proven, that would justify failure or other academic sanction. If the student

involved wishes to appeal the sanction imposed by the instructor, the student must initiate an appeal within two weeks after receipt of this notification. The Academic Appeals Committee shall consider as a basis for a hearing that: a) the student claims not to have been academically dishonest; b) the student claims the instructor imposed an inappropriate sanction; c) the nature of the offense merits further action. In academic dishonesty cases the Committee may receive requests for hearings from students, from individual faculty and staff members, and from the Registrar. The Academic Appeals Committee reserves the right not to hear any appeal in any case where data is not sufficient, the necessary steps have not been followed, and when the committee jurisdiction is not clear.

Further information regarding instructor and student rights and responsibilities and appropriate procedures to be followed in applying this policy may be obtained from the Office of the Dean of Academic Affairs or the Registrar.

Accommodations Statement

Students with disabilities who wish to access accommodations are advised to contact the **Office of Disability Resources at 413-662-5314** or stop by the office in Mark Hopkins Hall to schedule an appointment. The Office of Disability Resources will work individually with students to determine accommodations that are reasonable for them. Based on the students' documentation, an accommodation plan is developed to facilitate equal access. It is the responsibility of the student to deliver and discuss their accommodation plan with their professor.

Find more disability resources at lnk.mcla.edu/accessLinks to an external site.

Tech Troubleshooting Policy

If you encounter technical difficulties, here is the procedure I expect you to follow:

1. **Check the relevant** Canvas Guide for an answer to your question. If this step doesn't resolve your issue, proceed to...
2. **Email the** MCLA Help Desk **from your @mcla.edu address, and CC me.** Providing a screenshot is often very helpful in diagnosing an issue.

I **may** consider technical difficulties as a mitigating factor in late or missed assignments, but **only if** you can document that you have first followed these procedures.

Tech Guides & Support

Looking for support using Canvas, Teams, or other MCLA tech tools? These resources can help you out!

- Help DeskLinks to an external site.**:** The Help Desk staff are ready to assist students with all aspects of their online life at MCLA, from resources like Banner, and Canvas to WiFi access to printing to email. They are available to help with your questions however you want to reach out:
    - TechHelp Chat from the MCLA PortalLinks to an external site.;
    - send an email to helpdesk@mcla.edu;
    - give them a call (413-662-5276).
- TechHelpLinks to an external site.**:** Your one-stop-shop for MCLA technology news, instructions, guides, and answers.
- Canvas Student GuideLinks to an external site.**:** Online guides for any questions that might come up. Learn how to use Canvas like a pro!
- **Canvas Mobile Guides**Links to an external site.: Use Canvas from your mobile device.
- **Tech Orientation**: A micro-course (less than 1 hour!) that gives you key info about MCLA's main tech systems.

MCLA Student Resources

The following resources are available to MCLA students. Check individual websites for current information about remote / on-campus services offered; appointments may be required.

- **Academic Advising and Support**Links to an external site.**:** Academic Advising and Support offers assistance with general questions regarding academic matters including learning strategies, academic program and graduation requirement information, core curriculum choices, and major or minor exploration.
- Career ServicesLinks to an external site.**:** Visit us in our office location in Bowman Hall for help with resumes, grad school applications, internships, mentoring, exam prep, and networking tools.
- Disability Resources:Links to an external site. MCLA is committed to providing reasonable accommodations to students with documented disabilities to ensure equal access to all MCLA programs. The Disability Resource Office provides eligible students with individual support services.
- Writing Studio:Links to an external site. The MCLA Writing Studio is a space where writers collaborate and create. All writers, from first-year students to faculty members, are welcome. Trained writing associates will collaborate with writers at any stage of the writing process: from understanding assignments and brainstorming ideas to planning, revising and polishing final drafts.
- Math Help Drop-In Center:Links to an external site. For help with mathematics, please visit MCLA’s Math Drop-In Center in CSI 101, or virtually on our Microsoft Teams channel. No appointment is needed! We are staffed by trained peer tutors who can help with math related to any course. We also offer tutoring for the GRE, MTEL, and other exams. For further information,

including weekly hours and how to access our Teams channel, please visit our website at mcla.edu/mathcenterLinks to an external site..

- Trailblazer Tutor Center:Links to an external site. The Trailblazer Peer Tutor Center can be found in Mark Hopkins hall on the first floor. Schedule an appointmentLinks to an external site. for one-on-one and group tutoring where you will be paired with a qualified peer tutor who can assist with course concepts, study tips, and provide you some dedicated study time. Visit early and often as this service is free and available to all students.
- Success ZoneLinks to an external site.**:** MCLA's 24/7 tool for free study skill resources covering topics such as time management and test preparation. Review these resources from the comfort of your own study space and connect with a Success Coach for more tips and skill building.
- Tech Help Desk:Links to an external site. The Tech Help Desk staff are ready to assist students with all aspects of their online life at MCLA, from resources like Email, Banner, Canvas, WiFi access to even troubleshooting device problems. You can ask them a question remotely via TechHelp Chat, by phone at 413-662-5276, or by sending an email to helpdesk@mcla.edu.
- Freel Library:Links to an external site. A center of learning and community, Freel Library provides MCLA students, faculty, and staff with collections, resources, services, information, technology, and informal spaces. You can get research help from librarians in person and online via chat.

Course Structure and Pacing

Self-Directed Learning Model: Students progress through structured modules at their own pace while meeting milestone deadlines. Multiple learning tracks accommodate different experience levels and time availability.

Learning Pathways:

- **Accelerated Track:** Complete in 11 weeks with intensive study (12-15 hours/week)
- **Standard Track:** Complete in 14 weeks with steady progression (8-10 hours/week)

Weekly Schedule and Topics

Week 1: Course Setup and Cryptography Foundations (September 3 - September 9)

Learning Objectives: Environment setup and cryptographic fundamentals

- Development environment configuration and GitHub setup
- Symmetric encryption basics (AES) and key management
- Hash functions and digital signatures introduction
- Python cryptography library basics

Major Deliverables:

- Environment Setup Verification
- Basic Cryptographic Implementation (Python)

Week 2-3: Advanced Cryptography and PKI (September 10 - September 23)

Learning Objectives: Master cryptographic systems and secure communications

- Asymmetric encryption (RSA, ECC) implementation
- Public Key Infrastructure (PKI) and certificate management
- TLS/SSL configuration and analysis
- Cryptographic vulnerabilities and best practices

Major Deliverables:

- PKI Certificate Authority Setup
- Secure Communication System with TLS

Week 4-5: Authentication and Access Control (September 24 - October 7)

Learning Objectives: Design identity management systems

- Multi-factor authentication implementation
- Role-based access control (RBAC) fundamentals
- Single Sign-On (SSO) and basic identity protocols
- Authentication security and common vulnerabilities

Major Deliverables:

- MFA Authentication System
- RBAC Implementation Project

Week 6-7: Network Security and Monitoring (October 8 - October 21)

Learning Objectives: Deploy network defense systems

- Firewall configuration and rule management
- Intrusion Detection Systems (IDS) deployment
- Network monitoring and basic incident response
- Security logging and alerting

Major Deliverables:

- Firewall Configuration Project
- Network Security Monitoring Setup

Week 8-9: Security Assessment and Architecture (October 22 - November 4)

Learning Objectives: Integrate security controls and perform assessments

- Security architecture design principles
- Vulnerability scanning and basic penetration testing
- Security operations and monitoring integration
- Risk assessment fundamentals

Major Deliverables:

- Security Architecture Design
- Vulnerability Assessment Laboratory

Week 10-11: Digital Forensics Foundations (November 5 - November 18)

Learning Objectives: Master digital forensics basics

- Forensic investigation methodology and legal compliance
- File system analysis (Windows, Linux, Mac)
- Data recovery and timeline analysis
- Evidence preservation procedures

Major Deliverables:

- Forensic Workstation Setup
- File System Analysis Project

Week 12-13: Advanced Forensics and Mobile Analysis (November 19 - December 2)

Learning Objectives: Investigate advanced threats and mobile devices

- Memory analysis fundamentals with Volatility
- Network traffic analysis and communication reconstruction
- Android emulation forensics and mobile app analysis
- Evidence correlation and integration techniques

Major Deliverables:

- Memory/Network Forensics Project
- Mobile Forensics Laboratory

Note: November 27-28 - Thanksgiving Break (No assignments due)

Week 14: Integration and Final Projects (December 3 - December 12)

Learning Objectives: Demonstrate comprehensive knowledge and complete capstone

- Final project completion and documentation
- Peer presentations and project demonstrations
- Course integration and professional portfolio development
- Career planning and certification preparation

Major Deliverables:

- Final Capstone Project Submission
- Project Presentations (Teams or face-to-face) and Peer Reviews