COMPUTER FORENSICS (CFRS)

500 Level Courses

CFRS 500: Introduction to Forensic Technology and Analysis. 3 credits.
 Presents an overview of technologies of interest to forensics examiners. It will provide an introduction to, software, hardware, analysis, and other aspects required for forensic examinations. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the following colleges:
• College of Science
• Schar School of Policy and Gov
• School of Business
• Volgenau School of Engineering

Schedule Type: Lecture
Grading:
This course is graded on the Graduate Regular scale.

CFRS 510: Digital Forensics Analysis. 3 credits.
Explains computer forensics crime scene procedures, beginning with initial walk-through and evaluation; identification and collection of potential evidence; preparation of intrusion investigation; aspects of working with investigators and attorneys; reverse engineering with file identification and profiling; application of critical thinking in determination of significance of artifacts; and analysis and reporting of evidence. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

Schedule Type: Lecture
Grading:
This course is graded on the Graduate Regular scale.

CFRS 590: Special Topics in Computer Forensics. 3 credits.
Presents selected topics from recent developments and applications in various computer forensics disciplines. Helps the professional computer forensics community keep abreast of current developments, and provides an applications-oriented introduction to emerging areas of computer forensics. Offered by Electrical & Comp. Engineering. May be repeated within the degree for a maximum 6 credits.

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

Schedule Type: Lecture
Grading:
This course is graded on the Graduate Regular scale.

600 Level Courses

CFRS 660: Network Forensics. 3 credits.
Deals with the collection, preservation, and analysis of network-generated digital evidence such that the evidence can be successfully presented in a court of law (both civil and criminal). The relevant federal laws will be examined as well as private sector applications. The capture/intercept of digital evidence, the analysis of audit trails, the recording of running processes, and the reporting of such information will be examined. Offered by Electrical & Comp. Engineering. May not be repeated for credit. Equivalent to TCOM 660.

Recommended Prerequisite: TCOM 535 and a working knowledge of computer programming.

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the following colleges:
• College of Science
• Schar School of Policy and Gov
• School of Business
• Volgenau School of Engineering

Schedule Type: Lecture
Grading:
This course is graded on the Graduate Regular scale.

CFRS 661: Digital Media Forensics. 3 credits.
Covers the collection, preservation, and analysis of digital media such that the evidence can be successfully presented in a court of law (both civil and criminal). The relevant federal laws and private sector applications will be examined, as well as the seizure, preservation, and
analysis of digital media. Offered by Electrical & Comp. Engineering. May not be repeated for credit. Equivalent to TCOM 661.

**Recommended Prerequisite:** CFRS 500 and a working knowledge of computer operating systems (e.g. CS 471, IT 342, or equivalent).

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the following colleges:

- College of Science
- Schar School of Policy and Gov
- School of Business
- Volgenau School of Engineering

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**CFRS 663:** *Operations of Intrusion Detection for Forensics.* 3 credits.
Introduces students to network and computer intrusion detection and its relation to forensics. Addresses intrusion detection architecture, system types, packet analysis, and products. Presents advanced intrusion detection topics such as intrusion prevention and active response, decoy systems, alert correlation, data mining, and proactive forensics. Offered by Electrical & Comp. Engineering. May not be repeated for credit. Equivalent to TCOM 663.

**Recommended Prerequisite:** TCOM 509 and TCOM 529, and a working knowledge of computer programming.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**CFRS 698:** *Independent Reading and Research.* 1-3 credits.
Studies selected area in computer forensics under the supervision of a faculty member. A written report is required. Notes: No more than a total of six credits may be taken from a combination of CFRS 698 and CFRS 798 for credit within the CFRS program. Offered by Electrical & Comp. Engineering. May be repeated within the degree for a maximum 6 credits.

**Recommended Prerequisite:** At least two core courses in the CFRS program; and permission of instructor

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Research

**Grading:**
This course is graded on the Graduate Regular scale.

**700 Level Courses**

**CFRS 710:** *Memory Forensics.* 3 credits.
Introduces students to memory forensics, specifically the acquisition, investigation, and analysis of artifacts that reside in random access memory (RAM). Memory forensics provides an evidentiary wellspring of unique digital artifacts with regards to computer forensics and digital investigations (e.g. intrusion and malware incidents). Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** CFRS 500 and CFRS 660

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**CFRS 720: Digital Audio Video Forensics.** 3 credits.

Presents an overview of digital multimedia (audio, images, video) forensic analysis to include methods, legal framework, software, hardware, and other aspects required for forensic/investigative examination. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** CFRS 500 and CFRS 661

**Registration Restrictions:**

Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may not enroll.

**Schedule Type:** Lecture

**Grading:**

This course is graded on the Graduate Regular scale.

**CFRS 725: Linux Forensics.** 3 credits.

Presents the concepts, tools, and techniques used for forensic collection and analysis of Linux based operating systems and filesystems. Introduces, demonstrates, and discusses current research in the use of the Linux operating system and open source forensic tools with emphasis on developing custom functionality from multiple components. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** CFRS 500 and CFRS 661

**Registration Restrictions:**

Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may not enroll.

**Schedule Type:** Lecture

**Grading:**

This course is graded on the Graduate Regular scale.

**CFRS 730: Forensic Deep Packet Inspection.** 3 credits.

Presents tools, techniques, and methodologies used to conduct deep packet forensic analysis. Application of industry best practices to both the collection and subsequent analysis of network packets with an emphasis on hands-on exercises using various digital analytical tools. Notes: Course will consist of exercises conducted in a lab environment with concurrent lectures (combined total of 3 credits for lab and lecture exercises). Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** CFRS 660.

**Registration Restrictions:**

Enrollment limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may not enroll.

**Schedule Type:** Laboratory, Lecture

**Grading:**

This course is graded on the Graduate Regular scale.

**CFRS 737: Cloud Forensics.** 3 credits.

Introduces students to various cloud platforms and their featured and prepares students to acquire memory, disk and other cloud resources from cloud providers. Students will perform forensics on gathered artifacts. The course will take students from understanding what resources are available in a cloud provider to what artifacts exists and how to capture and analyze them. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** CFRS 500 and CFRS 660 or permission from instructor Various cloud providers Virtual Machines and VM concepts Windows / Linux command line knowledge Basic scripting (Bash, python 2.7 and PowerShell)

**Registration Restrictions:**

Enrollment limited to students with a class of Advanced to Candidacy, Graduate or Non-Degree.

Students in a Non-Degree Undergraduate degree may not enroll.

**Schedule Type:** Lecture

**Grading:**

This course is graded on the Graduate Regular scale.

**CFRS 760: Legal and Ethical Issues in IT.** 3 credits.

Presents legal and ethics topics in the context of computer forensics. Includes legal principles, types of crimes, witness testimony, and forensics report writing. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** CFRS 500.

**Registration Restrictions:**

Enrollment limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**

This course is graded on the Graduate Regular scale.

**CFRS 761: Malware Reverse Engineering.** 3 credits.

Reviews disassembled code for potentially malicious binary, or piece of malware, in order to gain a better understanding of how a binary functions when executed. Analyzes behavioral aspects as they are executed in a controlled environment. Environment changes (file, system, network, process, etc.), network communications, communications with remote devices, and so on, are closely observed for actionable information. Notes: Course will consist of exercises conducted in a lab environment with concurrent lectures (combined total of 3 credits for lab and lecture exercises). Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** CFRS 500 and CFRS 660.

**Registration Restrictions:**

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may not enroll.
Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**CFRS 762: Mobile Device Forensics.** 3 credits.
Reviews forensic evidence contained within mobile devices, including address books, call logs, text messages, video files, audio files, and Internet history. Discusses procedures and technologies associated with mobile devices and how such procedures differ from traditional computer forensics. Analyzes collected data and correlates information with data from carriers. Hands-on exercises included. Notes: Course will consist of exercises conducted in a lab environment with concurrent lectures (combined total of 3 credits for lab and lecture exercises). Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** CFRS 500, CFRS 661.

**Registration Restrictions:**
Enrollment is limited to Graduate or Non-Degree level students.
Students in a Non-Degree Undergraduate degree may not enroll.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**CFRS 763: Registry Forensics - Windows.** 3 credits.
Presents the concepts, tools, and techniques used for forensic collection, identification, and analysis of the Windows registry; review the structure and layout of the Windows registry and be introduced to the types of artifacts that can be found within; evaluate and interpret data from the Windows registry with emphasis on hand-on exercises. Notes: Course will consist of exercises conducted in a lab environment with concurrent lectures (combined total of 3 credits for lab and lecture exercises). Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** CFRS 500, CFRS 661.

**Registration Restrictions:**
Enrollment is limited to Graduate or Non-Degree level students.
Students in a Non-Degree Undergraduate degree may not enroll.

**Schedule Type:** Laboratory, Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**CFRS 764: Mac Forensics.** 3 credits.
Presents the basic tools and techniques used to conduct a Mac and iOS forensic analysis. Application of industry best practices to both the collection and subsequent analysis of Mac iOS systems with an emphasis on hands-on exercises using currently available open-source and commercial tools. Notes: Course will consist of exercises conducted in a lab environment with concurrent lectures (combined total of 3 credits for lab and lecture exercises). Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** CFRS 500, CFRS 661.

**Registration Restrictions:**
Enrollment is limited to Graduate or Non-Degree level students.
Students in a Non-Degree Undergraduate degree may not enroll.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**CFRS 767: Penetration Testing in Computer Forensics.** 3 credits.
Presents the concepts, tools, and techniques used for penetration testing, vulnerability exploitation, assessment, reporting, and forensics; teaches multiple attack vectors as well as the defensive measures protecting against such attacks; focuses heavily on post attack forensics allowing for a complete picture of the attack process. Notes: Course will consist of exercises conducted in a lab environment with concurrent lectures (combined total of 3 credits for lab and lecture exercises). Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** CFRS 660, CFRS 663.

**Registration Restrictions:**
Enrollment is limited to Graduate or Non-Degree level students.
Students in a Non-Degree Undergraduate degree may not enroll.

**Schedule Type:** Laboratory, Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**CFRS 768: Digital Warfare.** 3 credits.
Presents concepts of forensic attribution, context, and motivations behind computer attacks including those tied to cyber warfare and cyber terrorism activities. Tactics, techniques, and procedures of current cyber-attacks will be addressed. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** CFRS 500, CFRS 660.

**Registration Restrictions:**
Enrollment is limited to Graduate or Non-Degree level students.
Students in a Non-Degree Undergraduate degree may not enroll.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**CFRS 769: Anti-Forensics.** 3 credits.
Presents concepts of anti-forensics and obfuscation used in order to inhibit, frustrate, and mislead computer forensics examiners. Techniques, attempts, and actions used to negatively impact the existence, volume, or amount of evidence from digital repositories will be examined with goal
of understanding and detecting anti-forensics. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** CFRS 500, CFRS 660.

**Registration Restrictions:**
Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Laboratory, Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**CFRS 770: Fraud and Forensics in Accounting.** 3 credits.
Prepares students to undertake forensic accounting, a specialty practice area of accounting, in order to develop the necessary expertise to be prepared to give expert evidence in any resultant trial. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** CFRS 500.

**Registration Restrictions:**
Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the following colleges:
- College of Science
- Schar School of Policy and Gov
- School of Business
- Volgenau School of Engineering

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**CFRS 771: Digital Forensic Profiling.** 3 credits.
Presents the application of criminal profiling to digital forensic evidence and cybercrime. Covers typologies of cyber criminals and reviews how the results of digital forensics can be used to profile individuals to better facilitate investigative interviews and prosecutions. Applies digital profiling to the identification of criminal behavior for insider threats and fraud. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** CFRS 500, CFRS 660.

**Registration Restrictions:**
Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Laboratory, Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**CFRS 772: Forensic Artifact Extraction.** 3 credits.
Presents tools and techniques for the extraction and processing of digital artifacts from various media and formats. Foundations are presented and examples are developed for Windows, Linux, Mac, and media filesystems, files, RAM, Windows Registry, solid state devices, network traffic, and mobile devices. Emphasis on applications and hands-on exercises. Notes: Course will consist of exercises conducted in a lab environment with concurrent lectures (combined total of 3 credits for lab and lecture. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** CFRS 500, CFRS 661.

**Registration Restrictions:**
Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Laboratory, Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**CFRS 773: Mobile Application Forensics and Analysis.** 3 credits.
Presents mobile applications forensics and analysis. Analyze mobile applications on both the android and iPhone platforms in a lab environment in order to understand the weaknesses, pitfalls, and forensic challenges that exist or potentially exist when developing mobile client side software as well as identify forensic artifacts left behind from applications. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** CFRS 762.

**Registration Restrictions:**
Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Laboratory, Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**CFRS 775: Kernel Forensics and Analysis.** 3 credits.
Introduces students to low level programming analysis and low level API's. Students will learn the basics of kernel level device drivers, how to load and unload software from the kernel, modification of kernel objects, interrupt and call hooking and memory hiding techniques. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** CFRS 761.

**Registration Restrictions:**
Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.
**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**CFRS 780:** *Advanced Topics in Computer Forensics.* 3 credits.
Teaches advanced topics from recent developments and applications in various areas of computer forensics. Enhances the professional engineering community’s understanding of breakthrough developments in specific areas of computer forensics. Active participation of the students is encouraged in the form of writing and presenting papers in various research areas of the advanced topic. Offered by Electrical & Comp. Engineering. May be repeated within the term for a maximum 6 credits.

**Recommended Prerequisite:** Permission of Instructor.

**Registration Restrictions:**
Enrollment is limited to Graduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**Additional Course Details:** Title varies by section and/or semester

**CFRS 790:** *Advanced Computer Forensics.* 3 credits.
Capstone course for the MS in computer forensics program. Students will be exposed to case studies and be required to conduct computer forensic investigations of digital media, intercepted packet switched data, and multisource log information to successfully complete each case study. Notes: To be taken in the last year prior to the completion of degree requirement. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** CFRS 660, 661, and (663 or 664), and a minimum of 18 credits in the MS Computer Forensics Program prior to registration.

**Registration Restrictions:**
Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**CFRS 798:** *Research Project.* 1-3 credits.
Conduct a research project to be chosen and completed under guidance of a graduate faculty member that results in an acceptable technical report. Notes: No more than a total of six credits may be taken from a combination of CFRS 698 and CFRS 798 for credit within the CFRS program. Offered by Electrical & Comp. Engineering. May be repeated within the degree for a maximum 6 credits.

**Recommended Prerequisite:** At least two core courses and a minimum of 12 credits in the CFRS program; permission of instructor.

**Registration Restrictions:**
Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Thesis

**Grading:**
This course is graded on the Graduate Regular scale.