# Report of Cyber Courses and Resources in the Coastal Virginia Node of the Commonwealth Cyber Initiative

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# I. Executive Summary

This Report of Cyber Courses and Resources in the Coastal Virginia Node of the Commonwealth Cyber Initiative ("the Report") is intended to provide the Experiential Learning Committee and the Academic Curricula Committee with an overview of cyber-related resources such as curricula, experiential opportunities, and career pathway information. There are three main sections in the Report: (1) Highlight of Experiential Opportunities, which shows cyber-related experiential opportunities in the six higher educational partners in the Coastal Virginia Node of the Commonwealth Cyber Initiative, including Old Dominion University (ODU), Thomas Nelson Community College (TNCC), Tidewater Community College (TCC), Christopher Newport University (CNU), William & Mary (W&M), Norfolk State University (NSU), Paul D. Camp Community College (Camp), and Eastern Shore Community College (ESCC); (2) an overview of cyber-related courses, programs, and relevant certifications offered by the these educational partners; (3) a conclusion including a recommendation for regular updates on the Report using authors' searchable spreadsheet of the cyber curricula complied and the Virginia Community College System.

## II. Introduction

To provide a thorough survey of the information and avoid under-inclusivity, the Report adopts a very broad definition of "cyber" (from IT to cybersecurity) and "experiential opportunities (any practical work in which students can learn to solve real cyber-related problems)."  Section III below collects cyber-related experiential opportunities information. The authors used a wide range of keywords such as "capstone," "internship," "hands-on," and "lab" to identify these opportunities from the course catalogues and the official websites visited. Section IV offers a brief introduction to cyber courses, ranging from IT to cybersecurity, and resources each partner university currently offers—or has offered recently—to students interested in cybersecurity, from entry-level to expert-level. Lastly, Section V concludes with recommendations for regular updates, which can build upon the Report, including a searchable spreadsheet of the cyber-related curricula and the hyperlink to Virginia Community College System course catalog.

## III. Highlight of Experiential Opportunities

**<u>Old Dominion University</u> (ODU)**

ODU provides experiential opportunities as part of these courses:
- CYSE 301     Cybersecurity techniques and operation
- CYSE 494     Entrepreneurship in Cybersecurity
- IDS493     Electronic Portfolio Project
- CYSE697     Independent study in cybersecurity
- CYSE698     Master's project
- CYSE 270     Linux system for cybersecurity
- CS250     Problem-solving & Programming II
- CS252     Introduction to Unix for Programmers
- CS368     Computer Science Internship
- CS698     Master's Project
- IT 401     Mobile and Cloud Computing
- IT 419     Enterprise Cyber Defense.
- IT 634     Cloud Computing and Security
- IT 649     Information Systems and Network Security

*Systems Group*

The Computer Science Department Systems Group seek talented, self-motivated, and dedicated CS undergraduate students with two or more years remaining towards a degree who are interested in gaining hands-on experience in the field of Computer Science. Tasks will include systems administration, scripting, network administration, and more. Some experience with Windows Administration and/or Linux is preferred but not required.

*ODU CYBER Scholarship (undergraduate)*[4]

These are four-year scholarships ($8,888 per year, for a total of $35,552), available to talented students with demonstrated financial needs. In addition to strong academic support, including faculty mentoring, and peer tutoring, these scholarships offer acceptance to the ODU Cybersecurity Learning Community, opportunities to join the Cyberhacking Competition Team, and access to the Cybersecurity Virtual Lab. Selected students also have access to summer research internships and assistance with job placement, as well as other support provided by ODU such as the Student Success Center, Math & Science Resource Center, Writing Center, and Career Development Services.

*Cyber LeADERS Scholars Program, CyberCorps Scholarship Program*

In partnership with Thomas Nelson Community College (TNCC) and Tidewater Community College (TCC), ODU's School of Cybersecurity provides selected students the opportunity to receive 2-3 years of support. Students receiving the scholarship must work for the federal government in select cybersecurity positions for the same number of years for which they received scholarship support

*GenCyber Summer Camp 2020 (Virtual)*[5]

GenCyber is a nation-wide grant program funded by the National Security Agency (NSA) and the National Science Foundation (NSF). The GenCyber program provides summer cybersecurity camp experiences for students and teachers at the K-12 level. The goals of the program are to help all students understand correct and safe on-line behavior, increase diversity and interest in cybersecurity and careers in the cybersecurity workforce of the Nation, and improve teaching methods for delivering cybersecurity content in K-12 computer science curricula.

## **Thomas Nelson Community College (TNCC)**

TNCC cybersecurity students who intend to transfer to ODU's bachelor's in science in a cybersecurity program may save time and tuition by transferring credits. Funding is provided in the student's last year at the community college and for two years at ODU. TNCC also has a STEM based program which is called ELSAM for the students who are in the department of science, technology, engineering and mathematics. TNCC also has fellowship programs which are of two types: The Minority Professional Teaching Fellows and the Graduate Student Teaching Fellows (Eligible students are those who have earned a master's degree or in Senior year).

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[4] https://www.odu.edu/cyber/stem
[5] http://securitybehavior.com/gencyber-camp/index.html

- **Center of Academic Excellence in Cyber Defense Education for 2-year Colleges:**
  The National Security Agency and the Department of Homeland Security have designated Thomas Nelson as a National Center of Academic Excellence in Cyber Defense Education for two-year institutions. This certification is valid for the academic years 2017 – 2022.
- **Cybersecurity Resources:** Virginia Space Grant Consortium.

## Tidewater Community College (TCC)

TCC's cybersecurity program teaches students the skills they need for a promising career in preventing, detecting, and battling digital crime from threats like hackers, malware, spyware, and viruses. Students may also qualify to earn the industry-recognized CompTIA Security+ certification.

TCC offers an opportunity for the student who is in STEM major, from the collaboration with Virginia Space Grant Consortium they are offering internship and research experience opportunities to the students. TCC also has a STEM promise program which offers scholarships that pay four semesters of tuition and fees in full, to high school seniors, adult learners and military-related students who want to pursue careers in science, technology, engineering, and mathematics (STEM).

## Christopher Newport University (CNU)

CNU provides experiential opportunities including these courses:
- CPSC430      Simulation Modeling
- CPSC440      Database management systems
- CYBR498W   Cybersecurity Capstone
- CPSC336      Network Implementation and Administrator I
- CPSC410      Operating systems

CNU provides funds to support student research and creative projects each semester. These $1,000 awards are designed to support independent research and creative work inspired by students' coursework or something that interests students based on faculty expertise.

The Research Apprentice Program (RAP) offers students an opportunity to apply what they learn in the classroom to discover new knowledge, solve real-world problems, pursue creative endeavors and develop professionally while working for a faculty member on a scholarly or creative project.

RAP is a paid, mentored learning experience, and includes specially-designed workshops that introduce students to a community of scholars where they can gain a better understanding of what research and creative artistry entail and why people do it.

CNU encourages students to expand the boundaries of exploration and provides funds up to $500 to eligible undergraduates traveling either regionally, nationally, or internationally to present research or creative work or to collect research data.

## William & Mary (W&M)

W&M provides several experiential opportunities including these courses:
- DATA 442    Neural Networks & Deep Learning
- DATA 498    Internship
- CSCI 545    Mobile Application Security
- CSCI 564    Applied Cybersecurity
- CSCI 597    Problems in Computer Science
- CSCI 626    Data Analysis and Simulation
- CSCI 654    Advanced Computer Architecture

In addition, faculty and students in the Department of Computer Science participate in joint research activities with two nearby national research facilities: the NASA Langley Research Center (NASA LaRC) and the Thomas Jefferson National Accelerator Facility (Jefferson Lab). The Department of Computer Science has both state-supported teaching assistantships and federally supported research assistantships. Most first-year graduate students are teaching assistants, whose duty includes helping maintain our Unix/Linux network, adding new user accounts, installing new workstations, as well as teaching support in laboratory sections and classrooms.

## Norfolk State University (NSU)

NSU provides experiential opportunities including these courses:
- CSC 170l    Computer Programming I Lab
- CSC 260l    Computer Programming II Lab
- EEN-202L-01 Elect Network Lab II
- CSC-313-01  Network Admin.
- CYS 573     Network Fundamentals
- PSY 600     CyberPsychology Internship
- CYS-672-90  Computer and Network
- PSY 690     CyberPsychology Capstone
- CYS 697     Ethical Hacking and Penetration Testing
- CSC 702     Practicum
- CYS 795     Cybersecurity Capstone
- CSC-445-01  Computer Network Defense

NSU offers Scholarship for Service (SFS), a program administered and funded by the National Science Foundation (NSF) in cooperation with the U.S. Office of Personnel Management (OPM). Students awarded a scholarship incur a service obligation to a governmental agency upon graduation from NSU and are required to participate in a paid internship during the summer sessions.

Another opportunity for teachers in the STEM area is the GenCyber Teacher Camp (GenCyber). GenCyber will introduce a curriculum that interested teachers can use to introduce the GenCyber concepts in their classrooms in a fun and engaging approach.

### Paul D. Camp Community College (Camp)

Camp has hosted a STEM summer camp for middle school girls since 2017, in partnership with Verizon and the National Association for Community College Entrepreneurship. Furthermore, Camp has many Career Pathway programs related to cyber and IT, such as Cybersecurity, Computer Support Specialist, and Principles of Robotics. (Note: because Career Pathway programs are career-oriented, it has been assumed that they can be listed as experiential opportunities, although the website does not have specific information about internship or hands-on experience.)

### Eastern Shore Community College (ESCC)

ESCC offers "On-the-Job Training" and "Customized Training", by which employers are funded to help students gain hands-on experience, though it is not a cyber-specific opportunity. In addition, ESCC provides internship opportunities in information technology and electronics technology. Specifically, the ESCC STEM Internship program has placed interns at the NASA Wallops Flight Facility.

### Virginia Community College System (VCCS)

TNCC, TCC, ESCC, and Camp are part of the Virginia Community College System, and thus they generally offer the following experiential opportunities in their course catalogue:

- ITN 90          Coordinated Internship
- ITN 96          On-Site Training
- ITN 97          Cooperative Education
- ITN 150        Networking Fundamentals and Introductory Routing – CISCO
- ITN 151        Introductory Routing and Switching – CISCO
- ITN 154        Network Fundamentals, Router Basics, and Configuration (ICND1) – CISCO

- ITN 154L   Network Fundamentals, Router Basics, and Configuration (ICND1) – Laboratory
- ITN 155   Switching, Wireless, and WAN Technologies (ICND2) – CISCO
- ITN 155L   Switching, Wireless, and WAN Technologies (ICND2) – CISCO Laboratory
- ITN 156   Basic Switching and Routing – CISCO
- ITN 157   WAN Technologies – CISCO
- ITN 246   IP Routing (ROUTE) – CISCO
- ITN 247   IP Switched Networks (SWITCH) – CISCO
- ITN 248   IP Network Troubleshooting and Maintenance (TSHOOT) – CISCO
- ITN 250   Scalable Internetworks (BSCI) – CISCO
- ITN 251   Secure Converged Wide Area Networks (ISCW) – CISCO
- ITN 252   Multilayer Switched Networks (BCMSN) – CISCO

# IV. Overview of Colleges and Universities Surveyed

**Old Dominion University (ODU)**

The School of Cybersecurity supports ODU's goal to serve its students and improve the diversity of the Commonwealth of Virginia, the nation, and the world through rigorous academic programs, strategic partnerships, and active civic engagement. ODU's main goal is to promote cybersecurity research and education in an interdisciplinary setting. Faculty and staff from across all colleges and reporting units at the university, including Information Technology Services, VMASC, and Military Affairs.

Here follows a qualitative summary of ODU's features in cybersecurity courses:

1. The Department of Cybersecurity provides a wide range of cyber-related training while Computer Science, Information Technology, and other undergraduate departments have greater expertise in offering cybersecurity courses related to policy, risk management, and interdisciplinary training opportunities. ODU offers a B.S. degree in Cybersecurity and an M.S. degree in Cybersecurity.

   - The researcher collected all the courses related to the keywords "security" "network" "database" from ODU's course catalog.
   - ODU also offers certificates that can help students gain and show technical knowledge.
   - All courses from the catalog that responded to the keywords were added to the list.

2. As part of several technical classes in cybersecurity, ODU requires students to engage in experiential learning. The objective is to provide greater and more practical knowledge enhancing the students' preparation for the professional world. ODU also offers professional certificates that facilitate students entering the job market.

3. The Department of Cybersecurity publishes research projects and technical reports. Furthermore, ODU posts job opportunities for students interested in gaining experience in ITS departments as a help desk. ODU has also established a Mentor program for students interested in cybersecurity.

## Thomas Nelson Community College (TNCC)

The Cybersecurity Program at Thomas Nelson is designed to serve students who already have a degree or are separating from the military and have some experience and are seeking a Cybersecurity specialization, as well as incoming freshmen seeking a career in Cybersecurity. Students will have the opportunity to earn several certifications as they progress through the Cybersecurity Program, including Network+ and Security+, and those who earn the AAS can choose to transfer to a partner four-year institution. TNCC also has a program for incoming freshmen who can begin with the AAS in IST (Information system Technology) and use the courses in the Cybersecurity for Enterprise Career Studies Certificate to fulfill the electives in the AAS program. The student graduates with two diplomas: an AAS in IT with a specialization in Cybersecurity and a Cybersecurity for Enterprise Career Studies Certificate. Lastly, TNCC also provides a Career studies certificate to get knowledge or in preparation for a career switch.

1. At TNCC, all cybersecurity-related classes are in Information technology or systems, and offered in Computer Science. They do not have any specific AS degree in cybersecurity, which can help to search easily.
2. TNCC has greater experience in offering cybersecurity-related certifications which can assist students without any degree to get entry-level jobs.
3. TNCC has recently added cybersecurity-related programs. These are being expanded to provide convenient options for students to study cybersecurity.

## Tidewater Community College (TCC)

TCC offers an AS degree of Applied Science in Cybersecurity, criminal justice, and database specialist.

1. The catalog has several cybersecurity courses with sharing classes of Information Technology, Cybersecurity, Computer Science, and Criminal Justice.
2. TCC offers certificates that are related to cybersecurity and information systems. It has also started a new program of certification in cybersecurity networking.
3. TCC also offers apprenticeship programs that are related to cybersecurity.

**Christopher Newport University (CNU)**

CNU offers cybersecurity-related courses in the Computer Science Department. At CNU, cybersecurity classes are shared with Information Technology, engineering, Computer Science. They also offer law classes linked to cybersecurity.

1. The cybersecurity major has its foundation in Computer Science and Information Science and focuses on protecting computing systems including hardware, software, and data.
2. CNU also offers classes of cybersecurity in the major of criminology, is in the department of Art and Humanities, and under Social Science.


**William & Mary (W&M)**

1. W&M offers a cybersecurity-related curriculum mainly through the Department of Computer Science, among other foundational courses in computer science. These courses include Applied Cybersecurity and Advanced Operating Systems. W&M has been working towards an interdisciplinary approach in cyber-related courses. For example, the Law School offers a Cyber Incident Response course, and Cyber and Information Security Essentials Seminar, whereas Raymond A. Mason School of Business offered cyber-related training to corporate management before the pandemic.
2. W&M has attracted adjunct and visiting professors who teach cybersecurity courses in different colleges and schools. For example, "5G security" is offered this semester by the Public Policy Program, but no details are available through the central catalog. Therefore, it is not possible to confirm whether a course like this is offered regularly if they do not include it in the course catalog.


**Norfolk State University (NSU)**

1. NSU has long established its reputation in its cybersecurity specialization. Specifically, it offers a B.S. degree in Computer Science with a Cybersecurity Track, and three M.S. degrees in Cybersecurity, Computer Science with an Information Assurance Track, and CyberPsychology. It is noteworthy that M.S. in CyberPsychology is the first such program offered in the United States. In addition, NSU is a designated National Security Agency (NSA) and Department of Homeland Security (DHS) Center of Academic Excellence in Cyber Defense Education (CAE-CD), with NSU Cybersecurity Complex including Datacenter & Cybersecurity Research Lab securely isolated from NSU network.
2. NSU also offers a basic course for computer science, but given its specialization in cybersecurity, the data collected related primarily to the cybersecurity course. Its M.S. in cybersecurity is an all-online degree, and it is not clear whether it is also open to in-person students. It has not been possible to determine who the main users of its Cybersecurity

Complex are (or whether NSU students can benefit from this valuable facility or whether it is accessible only to faculty or researchers).

**Paul D. Camp Community College (Camp)**

1. Camp offers a Career Studies Certificate related to cybersecurity. Its Information Tech Essential (ITE) and Information Technology Network (ITN) offer a wide range of introductory and intermediate level cybersecurity courses to help students complete the requirements of its Career Studies Certificate and other computing certificates such as A+, Network+, Security+.
2. Camp has a long cooperative relationship with NASA. Not only its students may have the experiential learning opportunities via fellowship or internship at NASA, but also they may also have the opportunity to be employed after graduation.

**Eastern Shore Community College (ESCC)**

1. ESCC has Workforce Programs to help students get computing certification in CompTIA A+ CompTIA, IT Fundamentals, CompTIA Network+, CompTIA Security +. Although ESCC does not offer a cybersecurity course, it provides entry-level courses in information technology. For example, its Information Literacy course, along with other network courses, may increase students' awareness of cybersecurity.
2. ESCC's website has little information on cybersecurity, as most of the courses are IT-related.

## V. Conclusion and Additional Information

Based on our findings above, the authors recommend regular updates on the Report, given the dynamic and fast-growing development in the cyber industry and education. Additionally, a guideline or keywords of experiential opportunities may be published or provided to faculties and staff for reference when they design such courses. For reference and further update, the chart representing the research conducted can be accessed here.[6] Virginia Community College System Course Catalog can be accessed here.[7]

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[6] https://docs.google.com/spreadsheets/d/1BT9_TQopSYYcV8tWttdCzUzTVP_kKXvx5AfTTF2RgRw/edit#gid=956838606

[7] For VCCS's Information Technology Networking (ITN) courses, please visit
https://courses.vccs.edu/courses/ITN-Information%20Technology%20Networking