




TO: Course Approval Committees

FROM: Stephen H. Edwards 
Associate Department Head for Undergraduate Studies

RE: 2021 B.S. in Computer Science, Secure Computing Major checksheet

DATE: November 27, 2018

The Department of Computer Science is requesting approval for the addition of two new majors/ checksheets for the Bachelor of Science in Computer Science degree. These new majors will provide greater opportunities for students to specialize and diversify within the degree, while also providing curricular structure for a rapidly growing subfield within the discipline. In accordance with SCHEV requirements, both new majors include a minimum of 25% of common credit-hours under the B.S. in CS degree.

This is a new checksheet for the Secure Computing major, based on the Computer Science degree checksheet for 2020.

The Department of Computer Science does not require additional resources to offer this new major.



April 22, 2019

Proposal for new Major: Secure Computing

Justification for New Major in Computer Science

Student enrollments in computer science have been growing nation-wide over the past decade, with Department of Computer Science undergraduate enrollments tripling during this period. Enrollment within the Department is expected to continue to grow during the coming decade. During this time, public awareness of cybercrime and security vulnerability of computing systems has grown dramatically. While cybersecurity used to be a niche field associated with government agencies, cybersecurity is now a primary concern in nearly every field, including health care, finance, manufacturing, retail, and more. Major companies in every sector are potentially vulnerable to computer security threats, and there has been a huge increase in demand for well-trained computing professionals. Recent job reports indicate that cybersecurity job openings are growing three times faster than information technology jobs overall, and professionals hired into these positions earn significantly more as well.

The growth of computer security concerns in virtually all business sectors is placing a premium on future employees who have studied the techniques necessary to combat cyber threats. The creation of a new **Secure Computing** major within the CS degree will provide an opportunity for students to develop both the comprehensive background in computer science necessary to design and develop complex software systems and an understanding of the software security principles necessary to operate as a secure computing professional. While there are opportunities for students to study aspects of cybersecurity in several disciplines across Virginia Tech, this new major will capitalize on the strength of the existing Bachelor of Science in Computer Science degree program to offer this academic focus on top of the core technical computer science skills that employers value so heavily. It will allow students within computer science a greater opportunity to specialize and diversify within the degree, while providing curricular structure to ensure they obtain appropriate grounding in secure computing. This will position students uniquely to serve as security-aware software professionals that can build security in from the ground up when designing complex, interdisciplinary computer software solutions.

Strategic Plan

Stakeholders and constituents of the Department of Computer Science have provided feedback and support to the creation of the Secure Computing major. Both our Advisory Board and companies from our Computer Science Resources Consortium (including a healthy representation of companies who hire our students) have both discussed the new major and enthusiastically support its creation. Recruiters who attend our CSRC Career Fair each fall and spring have indicated that graduates with a computer security background are in especially high demand and have provided positive feedback for creation of the major. Student demand for the new major in particular is extremely high.

Students Served

The Department of Computer Science currently serves between 900-1,000 majors, with 350-400 new majors added each year, primarily transferring from the General Engineering major. Currently, all of these majors pursue the existing Computer Science major, which provides the same degree core but without any of the course focus on security in the new proposal. The new major in Secure Computing will serve the same audience. The primary purpose is to allow students within the existing major to select a more specialized plan of educational study that includes separate courses on secure computing, while simultaneously allowing students to highlight this educational specialization in a prominent way. This distinction is important in order to prepare students to compete effectively in the rapidly growing market for computer security professionals. Currently, many Computer Science majors pursue a Cybersecurity minor to achieve this end, but providing a more complete curriculum with a systems capstone course that can employ security specific topics offers students greater depth. At the same time, presence of such a major provides a fertile area for future curricular developments in software security, with an identified student population eager to see expansion in this area.

We expect students who enter the Secure Computing major to come from the same pool of prospective students as the current Computer Science major, and gains within the Secure Computing major will be offset by corresponding reductions in students seeking the more generalist major. Students who wish to pursue Computer Science more broadly without focusing on secure computing will still be able to pursue the existing major. Near term, we anticipate 30-35% of new BSCS students to pursue the Secure Computing major, and within ten years expect a steady state of 500 or more students within the major.

Resources Needed

The Secure Computing checksheet primarily reorganizes existing courses within the Computer Science program, with some elective options provided from Electrical and Computer Engineering. By reusing existing courses to the maximum extent possible, no new resources will be required to implement this new major at this time.

COLLEGE OF ENGINEERING
DEPARTMENT OF COMPUTER SCIENCE
BACHELOR OF SCIENCE IN COMPUTER SCIENCE
SECURE COMPUTING MAJOR
FOR STUDENTS GRADUATING IN CALENDAR YEAR 2021
123 CREDITS REQUIRED FOR GRADUATION

FALL SEMESTER FRESHMAN 2017		Credits	SPRING SEMESTER FRESHMAN 2018		Credits
CHEM 1035 General Chemistry Co: MATH 1025 or MATH 1225		3	PHYS 2305 Found of Physics I w/lab Pre: (MATH 1205 or MATH 1205H or MATH 1225) or (MATH 1206 or MATH 1206H or MATH 1226) Co: 2325 or (MATH 1206 or MATH 1206H or MATH 1226)		4
CHEM 1045 General Chemistry Lab Co: CHEM 1035		1			
ENGL 1105 First-Year Writing Pre: None		3	ENGL 1106 First-Year Writing Pre: ENGL 1105		3
MATH 1225 Calculus of a Single Variable (C-) Pre: Math Ready		4	MATH 1226 Calculus of a Single Variable Pre: MATH 1225 (C-)		4
ENGE 1215 Foundations of Engineering (C-)		2	ENGE 1216 Foundations of Engineering (C-) Pre: ENGE 1215 (C-)		2
CLE (Area 2, 3, or 7)		3	CS 1114 ^[1] Intro to Software Design (C)		3 ^[F, S, SI, SII]
TOTAL		16	TOTAL		16
FALL SEMESTER SOPHOMORE 2018		Credits	SPRING SEMESTER SOPHOMORE 2019		Credits
MATH 2204 ^[1] Intro Multivariable Calculus Pre: MATH 1226		3	COMM 2004 Public Speaking		3
MATH 2534 ^[1] Intro Discrete Math Pre: CS 1114 or ECE 1574 (Note: Math double majors take MATH 3034)		3 ^[F, S, SI]	MATH 2114 ^[1] Introduction to Linear Algebra Pre: MATH 1225 (B) or MATH 1226		3
Natural Science Elective		4	CS 2505 ^[1] Intro to Computer Organization I (C) Pre: 2114 (C); Co: MATH 2534 or MATH 3034		3 ^[F, S, SI]
CS 1944 Computer Science 1st Yr Sem Pre: 1114 (C)		1 ^[F, S]	CLE (Areas 2, 3, or 7)		3
CS/PSCI 2164 ^[2] Foundations of Complex Security Systems		3	CLE (Areas 2, 3, or 7)		3
CS 2114 Software Design & Data Structures (C) Pre: 1114 (C) or 1124 (C)		3 ^[F, S, SI, SII]			
TOTAL		17	TOTAL		15
FALL SEMESTER JUNIOR 2019		Credits	SPRING SEMESTER JUNIOR 2020		Credits
MATH 3134 Applied Combinatorics Pre: (MATH 1206 or MATH 1226), (MATH 2534 or MATH 3034) (Note: Math double majors take MATH 3124)		3	Statistics Elective		3
CS 2506 ^[1] Intro to Computer Organization II (C) Pre: 2505 (C), 2114 (C), (MATH 2534 or MATH 3034)		3 ^[F, S]	CS 3214 ^[1] Computer Systems Pre: 2506 (C), 2114 (C)		3 ^[F, S]
CS 3114 Data Structures and Algorithms (C) Pre: 2505 (C), 2114 (C), (MATH 2534 or MATH 3034)		3 ^[F, S, SI]	CS 3604 ^[1] Professionalism in Computing Pre: 1944, 3114 (C), COMM 2004		3 ^[F, S]
Professional Writing Elective		3	Secure Computing Elective ^[2]		3
CLE (Areas 2, 3, or 7)		3	CLE (Areas 2, 3, or 7)		3
TOTAL		15	TOTAL		15
FALL SEMESTER SENIOR 2020		Credits	SPRING SEMESTER SENIOR 2021		Credits
Secure Computing Elective ^[2]		3	CS 4944 Senior Seminar Pre: 3604		1 ^[F, S]
CS 4264 ^[2] Principles of Computer Security Pre: 3214 (C), or (ECE 2500 (C), ECE 3574 (C))		3	CS 4XXX Secure Computing Capstone ^[2]		3
CS 3/4XXX Elective		3	Secure Computing Elective ^[2]		3
CS Technical Elective		3	CS 3/4XXX Elective		3
Free elective		4	CLE (Area 6)		3
TOTAL		16	TOTAL		13

General Information about Checksheet: Superscripted annotation after the course number [1] indicates core course for the degree, or [2] requirement specific to the major. Superscripted annotation [F,S,SI,SII] in Credits column indicates that a course is known to be offered in the terms shown. Course offerings are subject to change and the availability of sufficient resources. Students should confirm course offerings in advance with their department.

Curriculum for Liberal Education (CLE)

Consult the CLE Alphabetical Listing at: <http://www.cle.prov.vt.edu/guides/alpha.html>, CLE courses need to be completed prior to graduation.

CLE Area 1: Writing and Discourse (6 hrs)	ENGL 1105	(3)	ENGL 1106	(3)
CLE Area 2: Ideas, Cultural Traditions, Values Electives (6 hrs)		(3)		(3)
CLE Area 3: Society & Human Behavior electives (6 hrs)		(3)		(3)
CLE Area 4: Scientific Reasoning and Discovery (8 hrs)	CHEM 1035 + 1045	(4)	PHYS 2305	(4)
CLE Area 5: Quantitative and Symbolic Reasoning (8 hrs)	MATH 1225	(4)	MATH 1226	(4)
CLE Area 6: Creativity & Aesthetic Experience elective (1 or 3 hr)	(1 or 3)			
CLE Area 7: Global Issues Elective (3 hrs)	(3)			

If a CLE course is double-counted to satisfy two different CLE areas, a free elective(s) must be taken to maintain a minimum of 123 credits.

Additional Requirements and notes:

- 1. CS Non-Technical Course Requirement.** B.S. in CS students must complete 30 credits of non-technical courses. All courses are approved as non-technical courses except those in the departments of Biological Sciences, Chemistry, Geosciences, Physics, Mathematics, and Statistics, and all departments in the College of Engineering, except for engineering courses satisfying CLE Area 7. Also excluded are courses listed as CS technical electives.
- 2. Independent Study/Undergraduate Research.** No more than a total of 6 credits of CS Independent Study (4974) and/or CS Undergraduate Research (4994) may be used to fulfill CS degree requirements. To take Independent Study (2974 or 4974), a minimum overall and in-major GPA of 2.5 is required. To take Undergraduate Research (4994), a minimum overall GPA of 2.5 and an in-major GPA of 3.0 is required. CS 4974 and 4994 also require completion of CS 3114 with a grade of C or better.
3. See checksheet page 3 for definitions of each elective category and a list of approved courses for each.

Change of Major Requirements: Please see <http://www.enge.vt.edu/undergraduate-changing-majors.html>

Foreign Language Requirements: Students must have had 2 years of a foreign language in high school or one year at the college level (6 credit hours) of the same language. College-level credits used to meet this requirement do not count towards the degree.

Satisfactory Progress Towards Degree: University Policy 91 outlines university-wide minimum criteria to determine if students are making satisfactory progress towards the completion of their degrees. The CS Department fully supports this policy. Specific expectations for satisfactory progress for Secure Computing majors are as follows:

- Each student must meet the minimum University-wide criteria as described in Policy 91 and summarized in the Undergraduate Catalog (<http://www.undergradcatalog.registrar.vt.edu/1617/academic-policies.html#22>).
- Be registered in at least one 3-credit course required in the major during each on-campus semester of the regular academic year.
- Maintain an in-major GPA of 2.0 or better (calculated using all classes with a CS designator).
- Not take any CS course required in the major more than twice, including attempts ending in course withdrawal.
- Not repeat more than 3 CS courses required in the major, including attempts ending in course withdrawal.

Statement of Prerequisites: Pre-requisites for each course are listed after the course title. The (letter grade) notation, such as (C), indicates the minimum grade students must earn in the pre-requisite course. There are no hidden pre-requisites in the program of study. Prerequisites may change from what is indicated. Be sure to consult the University Catalog or check with your advisor for the most current pre-requisites.

Graduation Requirements: To qualify for a B.S. degree in CS, a student must:

- Earn a "C" (2.0) or better in CS 1114, CS 2104, CS 2114, CS 2505, CS 2506 and CS 3114, and
- Complete at least 123 semester credit hours with a minimum overall GPA of 2.00 and a minimum in-major GPA of 2.00 (the in-major GPA is calculated using all classes with a CS designator).

Secure Computing Electives

Note: Some elective courses may include prerequisites not required by this checksheet. It is the student's responsibility to be aware of prerequisites and to ensure that all prerequisites are completed prior to enrolling in the chosen course. Some courses may be restricted to majors other than CS in some semesters. Check the Undergraduate Course Catalog and consult with an academic advisor to confirm your eligibility for specific electives. Actual course offerings are subject to availability of sufficient resources, including faculty availability and student demand.

1. Natural Science Elective. A minimum of 12 hours of natural science is required. Of those hours, 8 hours must be in a sequence. In addition to the required CHEM 1035/45 and PHYS 2305, this requirement may be satisfied by taking (a) CHEM 1036/46), (b) PHYS 2306, or (c) an eight hour sequence in Biology: BIOL 1105-6 & 1115-6.

2. Professional Writing Elective. Students must take one of the following:

- ENGL 3764 Technical Writing *Pre: ENGL 1106 or ENGL 1204H or COMM 1016*
- ENGL 3804 Technical Editing and Style *Pre: ENGL 1106 or ENGL 1204H or COMM 1016*
- ENGL 3814 Creating User Documentation *Pre: ENGL 1106 or ENGL 1204H or COMM 1016*
- ENGL 3824 Designing Documents for Print *Pre: ENGL 1106 or ENGL 1204H or COMM 1016*
- ENGL 3834 Intercultural Issues in Professional Writing *Pre: ENGL 1106 or ENGL 1204H or COMM 1016*
- ENGL 3844 Writing and Digital Media *Pre: ENGL 1106 or ENGL 1204H or COMM 1016*
- ENGL 4824 Science Writing *Pre: ENGL 1106 or ENGL 1204H or COMM 1016*

3. Statistics Elective. Students must take one of the following:

- STAT 4705 Probability and Statistics for Engineers *Pre: MATH 2224 or MATH 2204 or MATH 2204H*
- STAT 4714 Probability and Statistics for Electrical Engineers *Pre: MATH 2224 or MATH 2204 or MATH 2204H*
- CMDA 2006 Integrated Quantitative Sciences *Pre: CMDA 2005, MATH 2114, CMDA 2206*

4. Secure Computing Elective. Students must take three of the following:

- BIT 4604 Data Governance, Privacy and Ethics *Pre: BIT 2405 or CMDA 2014 or CS 1114 or CS 1054 or CS 1064*
- BIT 4614 Information Security *Pre: BIT 4554 or ACIS 4554*
- BIT 4624 Cybersecurity Analytics *Pre: BIT 4614*
- CS 3274 Software Reverse Engineering *Pre: 2114 (C)*
- CS 3754 Cloud Software Development *Pre: 2114 (C)*
- CS 4254 Computer Network Architecture and Programming *Pre: 3214 (C)*
- ECE 4560 Computer and Network Security Fundamentals *Pre: CS 3214 or ECE 2504*
- FIN 4014 Internet, Electronic, and Online Law
- MATH 4175 Cryptography I *Pre: MATH 3034 or MATH 3124 or MATH 3134 or MATH 3144 or MATH 3224 or MATH 4134*
- MATH 4176 Cryptography II *Pre: MATH 4175 or (MATH 3034, MATH 3124) or (MATH 3034, MATH 3134) or (MATH 3034, MATH 3144) or (MATH 3034, MATH 3224) or (MATH 3034, MATH 4134) or (MATH 3124, MATH 3134) or (MATH 3124, MATH 3144) or (MATH 3124, MATH 3224) or (MATH 3124, MATH 4134) or (MATH 3134, MATH 3144) or (MATH 3134, MATH 3224) or (MATH 3134, MATH 4134) or (MATH 3144, MATH 3224) or (MATH 3144, MATH 4134) or (MATH 3224, MATH 4134)*

5. Secure Computing Capstone Requirement. Students must complete one 4000-level CS capstone course in the secure computing area. Students may choose the course listed here, or other 4/5000-level CS courses that have received prior approval as fulfilling the secure computing capstone requirement.

- CS 4284 Systems & Networking Capstone *Pre: 3114, 3214*

6. CS Technical Elective. Secure Computing majors must satisfy a 3 credit technical elective requirement by taking one of:

1. Any 3-credit CS 3/4/5000-level course not otherwise used to fulfill a Secure Computing requirement can be used as a technical elective, including both Independent Study (CS 4974) and Undergraduate Research (CS 4994).
2. An approved 3000- or 4000-level course in another discipline that has significant technical content relevant to the science or application of computer science can be used as a technical elective.

- a. Requests to have a non-CS course approved as a technical elective are made by submitting a course syllabus to your CS advisor for review prior to enrolling in the course. This includes non-CS Independent Study (4974) and Undergraduate Research (4994) courses.
- b. Below is a listing of non-CS courses that are approved as technical electives.

Computer Science Technical Elective Courses

ACIS/BIT 4554	Networks & Telecommunications in Business (3H, 3C) Pre: ACIS 3504 or BIT 3424
AOE 4434	Introduction to Computational Fluid Dynamics (3H, 3C) Pre: MATH 2214
ART 3704	Topics in Computer Animation (3H, 3C) Pre: ART 2704
BIT 4424	Business Information Visualization & Analytics (3H, 3C) Pre: BIT 2406
BIT 4434	Computer Simulation in Business (3H, 3C) Pre: BIT 3414
BIT 4444	Web-based Decision Support Systems (3H, 3C) Pre: BIT 3444
BIT 4514	Database Technology for Business (3H, 3C) Pre: BIT 3424, BIT 4524
BIT 4544	Advanced Methods in Business Analytics (3H, 3C) Pre: BIT 3444 or ACIS 2504
BIT 4604	Data Governance, Privacy and Ethics (3H, 3C) Pre: BIT 2405 or CMDA 2014 or CS 1114 or CS 1054 or CS 1064
BIT 4614	Information Security (3H, 3C) Pre: BIT 4554 or ACIS 4554
BIT 4624	Cybersecurity Analytics (3H, 3C) Pre: BIT 4614
CMDA 3606	Mathematical Modeling: Methods and Tools II
COMM 4374	New Communications Technology (3H, 3C) Pre: COMM 2084 or COMM 4014
ECE 3544	Digital Design I (3H, 3C) Pre: ECE 2504
ECE 3574	Applied Software Design (3H, 3C) Pre: ECE 2574
ECE 4524	Artificial Intelligence and Engineering Applications (3H, 3C) Pre: ECE 2574, STAT 4714
ECE 4550	Real Time Systems (3H, 3C) Pre: ECE 4534 or CS 3214
ECE 4560	Computer and Network Security Fundamentals (3H, 3C) Pre: CS 3214 or ECE 2504
ECE 4564	Network Application Design (3H, 3C) Pre: ECE 2504, ECE 2574
ECE 4580	Digital Image Processing (3H, 3C)
ECE 4704	Principles of Robotic Systems (3H, 3C) Pre: (ME 3514, STAT 3704) or ECE 2704
GEOG/GEOS 4084	Modeling with GIS (3H, 3C) Pre: GEOG 2084
GEOG 4314	Analysis in GIS (3H, 3C) Pre: GEOG 4084
GEOG 4324	Algorithms in GIS (3H, 3C) Pre: GEOG 4084, CS 1044
MATH 4175	Cryptography I (3H, 3C) Pre: MATH 3034 or MATH 3124 or MATH 3134 or MATH 3144 or MATH 3224 or MATH 4134
MATH 4176	Cryptography II (3H, 3C) Pre: MATH 4175 or (MATH 3034, MATH 3124) or (MATH 3034, MATH 3134) or (MATH 3034, MATH 3144) or (MATH 3034, MATH 3224) or (MATH 3034, MATH 4134) or (MATH 3124, MATH 3134) or (MATH 3124, MATH 3144) or (MATH 3124, MATH 3224) or (MATH 3124, MATH 4134) or (MATH 3134, MATH 3144) or (MATH 3134, MATH 3224) or (MATH 3134, MATH 4134) or (MATH 3144, MATH 3224) or (MATH 3144, MATH 4134) or (MATH 3224, MATH 4134)
MATH 4445	Introduction to Numerical Analysis (3H, 3C) Pre: MATH 2406H or (CMDA 2005, CMDA 2006) or (MATH 2214 or MATH 2214H), (MATH 2224 or MATH 2224H) or (MATH 2204 or MATH 2204H)
MATH 4454	Applied Mathematical Modeling (3H, 3C) Pre: MATH 3214
ME 4524	Robotics and Automation (3H, 3C) Pre: (ECE 2574, STAT 4714) or (ME 3514, STAT 3704)
MUS 3064	Digital Sound Manipulation (3H, 3C)
MUS 3065	Computer Music & Multimedia I (3H, 3C) Pre: MUS 2054
MUS 3066	Computer Music & Multimedia II (3H, 3C) Pre: MUS 2054, MUS 3065
PHYS 4755	Intro to Computational Physics (3H, 3C) Pre: PHYS 2306, CS 1044

Support Letters

From: **Kelly Pender** <pender@vt.edu>
Date: Wed, Nov 28, 2018 at 11:13 AM
Subject: Re: Seeking approval to include ENGL courses in BSCS checksheets
To: <edwards@cs.vt.edu>

Hi, Steve. Yes it is OK to keep the same requirements on the new checksheets.

best,
Kelly

Kelly Pender, PhD
Associate Chair, Department of English
Associate Professor of English
Virginia Tech
232 Shanks Hall (0112)
181 Turner St. NW
Blacksburg, VA 24061
pender@vt.edu
540-231-9077

From: **Douglas Cannon** <dfcannon@vt.edu>
Date: Wed, Nov 28, 2018 at 10:34 AM
Subject: Fwd: Fw: Seeking approval to include COMM course in BSCS checksheets
To: Stephen H Edwards <edwards@cs.vt.edu>

Steve: The Department of Communication concurs with the continued inclusion of COMM 2004 (Public Speaking) on the BSCS checksheet.

Douglas F. Cannon, Ph.D., [APR+M](#), [Fellow PRSA](#)
Assistant Head, Department of Communication
Virginia Polytechnic Institute and State University (Virginia Tech)

From: **Crawford, Tom** <tomc3@vt.edu>
Date: Wed, Nov 28, 2018 at 10:38 AM
Subject: RE: Seeking approval to include GEOG courses in BSCS checksheets
To: Stephen H Edwards <edwards@cs.vt.edu>

Steve,

This looks good. You may use this e-mail as my approval of using these courses on your checksheets for the new majors.

Sincerely,

Tom Crawford, PhD

Department Chair & Professor

[Department of Geography](#)

(540) 231-7216 | tomc3@vt.edu

From: **Jason Crafton** <jcrafton@vt.edu>

Date: Wed, Nov 28, 2018 at 11:51 AM

Subject: Re: Seeking approval to include MUS courses in BSCS checksheets

To: <edwards@cs.vt.edu>

Cc: Paul Steger <psteger@vt.edu>

Hi Stephen,

This works on our end. The only hang up would be if/when we start having capacity issues in these courses, but I think that's a ways down the road.

Please let me know if you have any further questions.

From: **Easterwood, John** <jceast@vt.edu>

Date: Thu, Nov 29, 2018 at 1:48 PM

Subject: RE: Seeking approval to include FIN 4014 in new BSCS Secure Computing checksheet

To: Stephen H Edwards <edwards@cs.vt.edu>

Cc: Brownlee-Bowen, Leanne <lbrownle@vt.edu>, Hiller, Janine <jhiller@vt.edu>

Stephen, I approve.

John

From: **Kevin Concannon** <kevinc1@vt.edu>

Date: Thu, Apr 25, 2019 at 10:13 AM

Subject: Permission to include ART 3704 as a technical elective in Computer Science

To: Stephen H Edwards <edwards@cs.vt.edu>

Cc: Thomas Tucker <thomasjt@vt.edu>, Kevin Concannon <kevinconcannon@vt.edu>

Hi Steve

Elective use of this course by CS has been approved! Thank you.

Kevin



Stephen Edwards <edwards.stephen.h@gmail.com>

Seeking approval to include COMM 4374 in BSCS checksheets

Douglas Cannon <dfcannon@vt.edu>

Wed, Sep 4, 2019 at 3:12 PM

To: Stephen H Edwards <edwards@cs.vt.edu>

Steve: The Department of Communication supports the inclusion of COMM 4374: New Communications Technology as a technical elective on the Secure Computing and Data-Centric Computing major checksheets. Serving your students in this course should not require additional resources.

Please note that the course designator for New Communications Technology changes to JMC 4374 this semester.

Douglas F. Cannon, Ph.D., [APR+M](#), [Fellow PRSA](#)

Assistant Head, Department of Communication

Virginia Polytechnic Institute and State University (Virginia Tech)

[Quoted text hidden]

TO: University Governance

FROM: Roberta Russell, Department Head, Business Information Technology

DATE: December 13, 2018

RE: BIT elective courses for CS majors – Secure Computing; Data-Centric-
Computing

The Business Information Technology Department supports the inclusion of the following list of courses in the new BS in CS majors, Secure Computing and Data-Centric Computing. This will not require additional resources at this time.

ACIS/BIT 4554 Networks & Telecommunications in Business

BIT 4424 Business Information Visualization & Analytics

BIT 4434 Computer Simulation in Business

BIT 4444 Web-based Decision Support Systems

BIT 4514 Database Technology for Business

BIT 4544 Advanced Methods in Business Analytics

BIT 4604 Data Governance, Privacy and Ethics

BIT 4614 Information Security

BIT 4624 Cybersecurity Analytics



Roberta S. (Robin) Russell
Professor and Head
Department of Business Information Technology



Mathematics Department
225 Stanger Street
460 McBryde Hall
Blacksburg, VA 24061
Ph: (540) 231-6536
Fax: (540) 231-5960

January 25, 2019

Steven H. Edwards
Computer Science Department
Virginia Tech

Steve:

The Department of Mathematics supports the Computer Science Department's use of the current CS checksheet's mathematics requirements on the new checksheets. We also approve including the cryptography courses in the secure computing major's elective list. We are persuaded by your explanation that these new checksheets will not substantially affect the number of students pursuing the BS in CS degree since the College of Engineering's enrollment management plan will continue to impose the same enrollment limits on the BS in CS degree, so total enrollment across the current major plus these two new majors will fall under the same limits as the current single CS major.

We expect to be able to accommodate this change for the current size of the population of CS students with no new resources.

Best regards,

A handwritten signature in black ink, appearing to read 'R.C. Rogers'.

Robert C. Rogers
Professor and Associate Chair

November 29, 2018

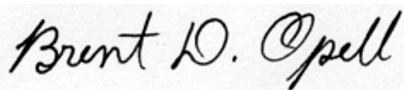
Stephen H. Edwards
Computer Science

Dear Steve,

The Department of Biological Sciences supports the inclusion of *BIOL 1105-6 & 1115-6* as one of the ways that a student can meet the natural sciences requirement as they pursue a BS in Computer Science, including your department's two new majors in *Secure Computing* and *Data-Centric Computing*.

Please be aware that availability of seats in each of these courses is dependent on sufficient resources from the College of Science and the University.

Yours sincerely,



Brent D. Opell
Chair, Curriculum Committee
Department of Biological Sciences

January 27, 2019

To Whom It May Concern:

The Department of Statistics strongly supports the creation of Computer Science's Data-centric Computing major, including the requirement for students to take either Probability and Statistics for Engineers (STAT 4705) or Probability and Statistics for Electrical Engineers (STAT 4714) or Integrated Quantitative Sciences (CMDA 2006).¹ We also support the addition of Nonparametric Statistics (STAT 3504), Methods of Regression Analysis (STAT 4214), and Applied Bayesian Statistics (STAT 4444) as electives in the new major.

At current Computer Science enrollment levels no additional resources are required for this change. However, for the sake of transparency, I point out a couple of issues that may arise as the Computer Sciences majors grow to support the state's Higher Education Package goals.

- **Current capacity:** We do note that all of the above Statistics classes are currently at capacity, and CMDA 2005/6 classes are also likely at or near capacity. Hence we expect to experience bottlenecks in these required courses until such time as the Department of Statistics is able to add more instructional capacity to support more sections. In addition, the three elective courses are at capacity and so the new Data-centric Computing majors will have difficulty getting into those classes until we are able to expand our capacity.
- **Future capacity:** with the new Higher Education Package enrollment targets for Computer Science, additional resources will almost certainly be required starting in academic year 2020-21 to expand our Probability and Statistics for Engineers (STAT 4705) and Probability and Statistics for Electrical Engineers (STAT 4714) offerings.

Sincerely,

David Higdon
Professor and Interim Head

¹ CMDA 2006 is a course in the College of Science's Academy of Integrated Science, so approval of this course is up to AIS, but it is worth noting here that 50 percent of the course is taught by Statistics faculty.



COLLEGE OF SCIENCE
ACADEMY OF
INTEGRATED SCIENCE
VIRGINIA TECH.

**Academy of Integrated Science
(0563)**

College of Science
Hahn Hal South, Suite 2108
Virginia Tech
800 West Campus Drive
Blacksburg, Virginia 24061
P: (540) 231-6073
F: (540) 231-3380
www.ais.science.vt.edu

April 23, 2019

Dear Dr. Edwards,

I approve adding the following CMDA courses to the 2021 Bachelor of Science in Computer Science checksheets:

1. For all majors in the Bachelor of Science in Computer Science degree program:
 - a. CMDA 2006 Integrated Quantitative Sciences as an alternative to fulfill the statistics requirement.
 - b. CMDA 3606 Mathematical Modeling: Methods and Tools as an elective on the CS Technical Elective list.
2. For the new Data-Centric Computing checksheet only:
 - a. CMDA/CS/STAT 3654 Introductory Data Analytics and Visualization as a required course.
 - b. CMDA/CS/STAT 4654 Intermediate Data Analytics and Machine Learning as an elective on the Data-Centric Computing Elective list.

Sincerely,

Michel Pleimling
Director, Academy of Integrated Science
Professor of Physics



VirginiaTech

College of Science

Department of Physics

Blacksburg, Virginia 24061

540-231-8740 Fax: 540-231-7511

E-mail: jhs@vt.edu

August 22, 2019

Dear Colleagues,

This letter is in support of the proposed checksheets for Secure Computing, and for Data-Centric Computing. The Physics Department has no problem with the inclusion of the physics courses in these checksheets.

Sincerely,

John H. Simonetti
Professor, Associate Chair of Physics
Virginia Tech

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Department of Chemistry
1040 Drillfield Drive
Davidson Hall 480
Blacksburg, Virginia 24061
P: (540) 231-8251
F: (540) 231-3255
Email: aesker@vt.edu

August 27, 2019

Prof. Stephen H. Edwards
Department of Computer Science (CS)

Resource Letter for Bachelor of Science Computer Science Checksheets for Two New Majors: Secure Computing and Data-Centric Computing

Dear Steve:

After reviewing your August 22, 2019 email regarding the Bachelor of Science (BS) in Computer Science (CS) Checksheets for your two new majors, Secure Computing and Data-Centric Computing I am now willing to offer conditional support. The present BS CS checksheet contains two required chemistry classes, Chem 1035 General Chemistry (first semester lecture) and Chem 1045 General Chemistry (first semester lab), and two potential electives, Chem 1036 General Chemistry (second semester lecture) and Chem 1046 General Chemistry (second semester lab). The checksheets for the new majors are consistent with the current major checksheet. CS undergraduates are expected to distribute across the various majors; but will also grow in the coming years. Under the PIBB, resources do align with teaching loads, but those resources lag by a year. Thus, should this degree result in minimal or slowly increasing enrollment in CS, sufficient resources should be available. However, should the new degree result in or contribute to a rapid or step change in enrollment, such as was experienced for Fall 2019, additional one-time resources may be required.

Sincerely,

A handwritten signature in black ink that reads 'Alan Esker'.

Prof. Alan R. Esker, Chair