DATE:       February 27, 2018

TO:         Jacqueline E. Huntoon
            Provost & VP for Academic Affairs
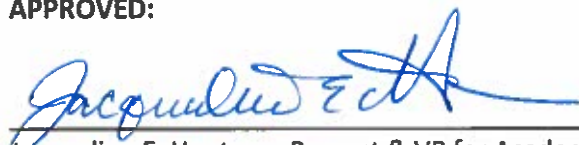
FROM:       Martin J. Thompson
            Senate President

SUBJECT:    Senate Proposal 10-18

COPIES:     Glenn D. Mroz, President
            Roberta M. Dessellier, Secretary of the Board of Trustees

At its meeting on February 21, 2018, the University Senate approved Proposal 10-18, "Minor in Cybersecurity". The Senate looks forward to approval of this proposal by the administration. Please keep me informed about the decision of the administration on this proposal and feel free to contact me if you have any questions.

APPROVED:

Jacqueline E. Huntoon, Provost & VP for Academic Affairs
on behalf of the University Administration

20 March 2018

Date

# The University Senate of Michigan Technological University

## Proposal 10-18

## Proposal for a
## Minor in Cybersecurity

### 1. Date

December 20, 2017

### 2. Proposer Contact Information

Yu Cai, Computer Network and System Administration Program Chair, School of Technology
Email: cai@mtu.edu

James Frendewey, Dean, School of Technology
Email: jimf@mtu.edu

### 3. Introduction

The proposed minor in cybersecurity is a joint effort of the School of Technology, the Department of Computer Science (CS) and the Department of Electrical and Computer Engineering (ECE). The minor will be hosted in the Computer Network and System Administration (CNSA) program in the School of Technology. The minor offers Michigan Tech students the opportunity to deepen their understanding of cybersecurity concepts and principles, learn offensive and defensive cybersecurity techniques, and develop professional skills to apply cybersecurity knowledge to the general area of their majors.

### 4. Rationale

Cyberattacks are becoming more common, sophisticated and damaging. People with cybersecurity skills are in great demand as the threat environment increasingly becomes more complex and challenging. The need to have a well-trained and well-prepared cybersecurity workforce is a pressing issue.

Recent cyber breaches indicate that cybersecurity is not just an IT issue, and likely won't be solved by cybersecurity people alone. In many cyberattacks, the initial targets are usually people with little or no cybersecurity knowledge who were used by hackers as stepping stones to high-value assets and data in corporate networks.

Therefore, there are strong needs to allow Michigan Tech students from all disciplines to learn cybersecurity, or at least be exposed to cybersecurity topics at the preparation stage of their professional careers. Simple and basic cybersecurity training such as anti-virus and anti-phishing do help, but are not sufficient in today's fast-changing environment. Students need a systematic way to learn what cybersecurity is, what the common threats are, how to design and develop secure systems, and how to protect sensitive information in workplaces.

One of the main challenges when designing a cybersecurity minor is the long prerequisite chains of the existing security courses in the CNSA, CS, and ECE programs. To open up the minor and streamline the course sequences, the prerequisites of six CNSA courses (SAT2711, SAT3210, SAT3310, SAT3812, SAT3820, and SAT4816) will be revised in 2018-2019 to allow non-CNSA students to take these courses. Table 1 lists the proposed changes to these CNSA courses.

Table 1 – Proposed Changes to Selected CNSA Courses

| Course | Credit | Title | Term | Old Prerequisites and Restrictions | Proposed changes on Prerequisites and Restrictions |
|--------|--------|-------|------|-----------------------------------|----------------------------------------------------|
| SAT2711 | 4 | Linux Administration I | Fall, Summer | SAT1610 | (SAT1200 or CS1111(C) or CS1121 or CS1131 or CS1142 or MIS2100) |
| SAT3210 | 3 | Database Management | Fall, Summer | SAT2711 | (SAT1200 or CS1111 or CS1121 or CS1131 or CS1142 or MIS2100)<br>Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior |
| SAT3310 | 3 | Scripting for Administration and Automation | Spring, Summer | SAT2711 | (SAT1200 or CS1111 or CS1121 or CS1131 or CS1142 or MIS2100)<br>Restrictions: Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior |
| SAT3812 | 3 | Cybersecurity I | Fall, Summer | SAT2711 | (SAT1200 or CS1111 or CS1121 or CS1131 or CS1142 or MIS2100)<br>Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior |
| SAT3820 | 4 | Wireless System Administration | Spring, Summer | SAT2711 | (SAT1200 or CS1111 or CS1121 or CS1131 or CS1142 or MIS2100)<br>Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior |
| SAT4816 | 3 | Digital Forensics | Fall | SAT2511 and SAT2711 | SAT3812 |

The minor is structured such that it is accessible to a broad range of majors at Michigan Tech including but not limited to Computer Network and System Administration, Computer Science, Computer Engineering, Management Information Systems, Electrical Engineering, and Mechanical Engineering.

There is a master's program in cybersecurity on campus as a joint effort of the Department of Computer Science, the Department of Electrical and Computer Engineering and the School of Technology. However, there is currently no undergraduate major or minor in cybersecurity. The proposed minor will strengthen Michigan Tech's educational efforts in this critical area.

## 5. Details

### I. Title of Minor

Cybersecurity

### II. Catalog Description

The minor in cybersecurity will provide students the opportunity to learn principles and practices of cybersecurity. The minor is designed for students from majors including but not limited to Computer

Network and System Administration, Computer Science, Computer Engineering, Management Information Systems, Electrical Engineering, and Mechanical Engineering.

Upon the successful completion of a minor in Cybersecurity, students will be able to:

a) understand various concepts, principles, and best practices in cybersecurity
b) utilize various cybersecurity tools, technologies, and mechanisms
c) develop technical skills to design and develop secure IT systems
d) apply cybersecurity principles and technologies to the general area of their majors
e) contribute to their communities and workplaces through application of their knowledge in cybersecurity.

## III. List of Courses

The cybersecurity minor requires a total of at least 18 credits, including 12 credits of required courses and 6 credits of electives.

Four courses are required as shown in Table 2. All students are required to take the following three courses: (CS1111 or CS1142), MA3203, and SAT3812. Students can select one more required course from the following courses: SAT4812, CS4471, or EE4723.

Students can select at least two elective courses from the list shown in Table 3.

All courses are taught at Michigan Technological University on a regular basis.

### Table 2 - Required Courses (12 credits)

| Course | Credit | Title | Term | Prerequisites and Restrictions |
|--------|--------|-------|------|-------------------------------|
| CS1111 <br><br> or <br> CS1142 <br><br> or <br> MIS2100 | 3 | Introduction to Programming in C/C++ <br><br> or <br> Programming at the Hardware Software Interface | Fall <br><br> or <br> Fall, Spring, Summer <br><br><br> Spring | No Prerequisites. See note 1 on restrictions. <br><br> or <br> (CS1122 or CS1131) <br><br><br> No prerequisites |
| MA3203 | 3 | Introduction to Cryptography | Spring, Summer | MA2320 or MA2321 or MA2330 |
| SAT3812 | 3 | Cybersecurity I | Fall, Summer | (SAT1200 or CS1111 or CS1121 or CS1131 or CS1142 or MIS2100) <br> Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior |
| Select one course from the list below | | | | |
| SAT4812 | 3 | Cybersecurity II | Spring | SAT3812 |
| CS4471 | 3 | Computer Security | Fall | CS3411 or CS4411 <br> Restrictions: May not be enrolled in one of the following Level(s): Graduate |
| EE4723 | 3 | Network Security | Spring | EE4272 or CS4461 |

Note 1: Restrictions: Must be enrolled in one of the following Major(s): Computer Network & System Admn, Electrical Engineering, Audio Production & Technology; Must be enrolled in one of the following Class(es): Freshman, Sophomore

Table 3 - Elective Courses (6 credits)

| Course | Credits | Title | Term | Prerequisites and Restrictions |
|---|---|---|---|---|
| CS3712 | 3 | Software Quality Assurance | Spring | CS3141 |
| CS4411 | 3 | Operating Systems | Spring | CS3331 and CS3421 |
| CS4431 | 3 | Computer Architecture | Fall, Spring | CS3421 |
| CS4471 | 3 | Computer Security | Fall | CS3411 or CS4411 Restrictions: May not be enrolled in one of the following Level(s): Graduate |
| CS4710 | 3 | Model-Driven Software Development | Spring | CS3311 and CS3141(C) |
| EE 4173 | 3 | Computer System Engineering and Performance | Fall, Spring | CS 3421 and EE 3173 Restrictions: Must be enrolled in one of the following Major(s): Computer Engineering |
| EE 4365 | 3 | In-Vehicle Communication Networks | Spring, Summer | (EET 1411 or EET 1120 or EE 2111 or EE 3010 or PH 2230) and EE 3250 |
| EE4723 | 3 | Network Security | Spring | EE4272 or CS4461 |
| SAT2711 | 4 | Linux Administration I | Fall, Summer | (SAT1200 or CS1111(C) or CS1121 or CS1131 or CS1142 or MIS2100) |
| SAT3310 | 4 | Scripting for Administration and Automation | Spring, Summer | (SAT1200 or CS1111 or CS1121 or CS1131 or CS1142 or MIS2100) Restrictions: Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior |
| SAT3820 | 4 | Wireless System Administration | Spring, Summer | (SAT1200 or CS1111 or CS1121 or CS1131 or CS1142 or MIS2100) Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior |
| SAT4816 | 3 | Digital Forensics | Fall | SAT3812 |
| CS3425 or MIS3100 or SAT3210 | 3 | Introduction to Database Systems or Business Database Management or Database Management | (Fall, Spring) (Fall, Spring) (Fall, Summer) | ((CS 2311 or MA 3210) and CS 2321) or (MIS2000(C)) or ((SAT1200 or CS1111 or CS1121 or CS1131 or CS1142 or MIS2100) Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior) |
| CS4461 or EE4272 | 3 | Computer Networks | Fall, Spring | CS3411 |
| MIS 4200 | 3 | Management of Cyber Security | Spring | MIS2000 or CS1111 or CS1121 |

## IV. Prerequisites not listed in the Minor

Required courses:
CS1142 (CS1122 or CS1131)
SAT3812 (SAT1200 or CS1111 or CS1121 or CS1131 or CS1142 or MIS2100)
MA3203 (MA2320 or MA2321 or MA2330)
CS4471 (CS3411 or CS4411)
EE4723 (E4272 or CS4461)

Elective courses:
SAT2711 (SAT1200 or CS1111(C) or CS1121 or CS1131 or CS1142 or MIS2100)
SAT3210, SAT3310, SAT3820 (SAT1200 or CS1111 or CS1121 or CS1131 or CS1142 or MIS2100)
MIS3100 (MIS2000(C))
CS3425 ((CS 2311 or MA 3210) and CS 2321)
CS3712 (CS3141)
EE4272 or CS4461 (CS3411)
CS4411 (CS3331 and CS3421)
CS4431 (CS3421)
CS4710 (CS3311 and CS3141(C))
EE4173 (CS 3421 and EE 3173)
EE4365 (EET 1411 or EET 1120 or EE 2111 or EE 3010 or PH 2230) and EE 3250
EE4495 (CS 3411 and EE 4173)

## 6. New Course Descriptions
No new courses associated with a minor in Cybersecurity are proposed.

## 7. Estimated Costs

No additional costs will be associated with this minor at this time. No additional library resources will be required either. All required and elective courses are currently being taught on a regular basis, and there is existing capacity for additional enrollment of 10-15 students per year in terms of classroom seats, laboratory space, and available equipment.

If the minor proves to be popular and exceeds the enrollment cap, the School of Technology has resources to offer additional lab sections and summer sections for SAT courses.

## 8. Planned Implementation Date

This minor will be offered Fall 2018.

## 9. Appendix

The flowcharts of Computer Network and System Administration, Computer Science (BS in Computer Systems), and Computer Engineering programs for 2017-2018 academic year are included as an Appendix.