



Office of the Provost and
Senior Vice President for Academic Affairs

Phone: (906) 487-2440
Fax: (906) 487-2935

TO: Richard Koubek, President

FROM: Jacqueline E. Huntoon, Provost & Senior Vice President for Academic Affairs

Jacqueline E. Huntoon

DATE: April 26, 2019

SUBJECT: Senate Proposal 47-19

Attached is Senate proposal 47-19, "Proposal for a Bachelor of Science Degree in Cybersecurity," and a memo stating the Senate passed this proposal at their April 24, 2019 meeting. I have reviewed this memo and recommend approving the proposal.

I ✓ concur _____ do not concur

Richard Koubek, President

4/29/19

Date



Michigan Tech

University Senate

DATE: April 25, 2019
TO: Richard Koubek, President
FROM: Michael Mullins
University Senate President
SUBJECT: Proposal 47-19
COPIES: Jacqueline E. Huntoon, Provost & Senior VP for Academic Affairs

At its meeting on April 24, 2019, the University Senate approved Proposal 47-19, “Proposal for a Bachelor of Science Degree 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.

The University Senate of Michigan Technological University
Proposal 47-19
(Voting Units: Academic)

Proposal for a
Bachelor of Science Degree in Cybersecurity

1. Date

April 8, 2019

2. Contact

Yu Cai, Chair of the Computer Network and System Administration Program, School of Technology

Adrienne Minerick, Dean, School of Technology

Other members

Todd Arney	School of Technology
Yu Cai	School of Technology
Bo Chen	Department of Computer Science
Christopher (Kit) Cischke	Department of Electrical and Computer Engineering
Dan Fuhrmann	Department of Electrical and Computer Engineering
Jean Mayo	Department of Computer Science
Adrienne Minerick	School of Technology
Zhenlin Wang	Department of Computer Science

3. Interdisciplinary programs require an attached approval from each department and dean

Approval forms: CS, ECE, SOT Dean, CSA Dean, COE Dean

4. General description and characteristics of program, including learning goals

Our nation is facing a significant shortage of trained and skilled cybersecurity professionals. The proposed Bachelor of Science degree in Cybersecurity aims to be part of the solution to the nation's cybersecurity workforce needs.

The new degree is a joint effort of the Computer Network and System Administration (CNSA) Program in the School of Technology, the Department of Computer Science (CS) in the College of Sciences and Arts, and the Department of Electrical and Computer Engineering (ECE) in the College of Engineering. The new degree is strategically designed to build on the strengths of

existing computing programs on campus and produce well-rounded students with a balance between strong theoretical foundations as well as practical and hands-on technical skills.

The new degree offers Michigan Tech students the opportunity to gain cutting-edge cybersecurity knowledge and skills with a solid theoretical foundation as well as a good understanding of the social, ethical, legal, and policy aspects of cybersecurity. Students learn to design and develop trusted software systems by adopting best practices and techniques in software development, manage and protect valuable computing infrastructure and data assets in an enterprise environment, and develop next-generation cyber skills to confront emerging cyber threats.

The new degree will be hosted at the new Computing College. The new college will be the campus leader in education and research activities related to computing and cyber technologies. The proposed B.S degree in Cybersecurity is an integral part of the new college and is consistent with the mission of Michigan Tech and the new college.

Learning Goals for the Proposed Major

1. Students will have the theoretical knowledge and technical skills to allow them access to competitive cybersecurity careers.
2. Students will have the skills to be life-long learners and thus the ability to keep pace with emerging security threats and current best practices in real-world cybersecurity.
3. Students will have the communication skills necessary for a variety of professional contexts and venues, and for public discussion and policy.
4. Students will be able to function effectively on a team.

5. Title of program

Bachelor of Science Degree in Cybersecurity

6. Rationale

Cybersecurity is a fast-growing field with a severe workforce shortage. Michigan Tech is one of the strong contenders in cybersecurity education and research at the State of Michigan. The new Computing College, the first-of-its-kind in Michigan, will elevate the visibility of Michigan Tech and better meet the market demand for computing education. Michigan Tech currently offers a Master's degree in Cybersecurity and a Minor in Cybersecurity. In addition, several departments and programs on campus currently offer courses with relevance to the cybersecurity field. The CNSA program and the Medical Informatics program at the School of Technology jointly offer a number of security courses with a strong emphasis on practical and hands-on learning in network management and system administration. The CS department offers a spectrum of courses with a strong emphasis on secure software development and computational security. The ECE department and the Mechanical Engineering-Engineering Mechanics (MEEM) department offer several specialized security courses on cyber-physical systems, industrial control systems, and automotive systems. Other departments and schools including the Math department, the Social Science

department, and the Management Information Systems (MIS) program at the School of Business and Economics also offer courses related to cybersecurity.

The proposed program is designed to take advantage of the unique opportunity presented at Michigan Tech by the presence and interaction of these programs and departments. By building on the existing foundation and faculty expertise, the proposed program can be developed at a relatively low cost. It is a natural and long-awaited move to offer a B.S. degree in Cybersecurity at Michigan Tech.

Currently, the proposed B.S. in Cybersecurity degree has the following two concentrations.

1) Software Security: In this concentration, students will learn to systematically design, develop, deploy and test trusted software and applications. Students will find and fix common software and application vulnerabilities to prevent attackers from exploiting them.

2) System and Network Security: In this concentration, students will learn to manage and secure computer systems, networks, and IT infrastructure from unauthorized access, attacks, misuse, or damage by implementing various security processes, technologies, and best practices.

There is an opportunity for an expansion into a third concentration focused on cybersecurity for critical infrastructure protection and cyber-physical systems. This would more directly involve the departments of ECE and MEEM.

6.1 A quick explanation of different computing disciplines:

In 2005, the Association for Computing Machinery (ACM) identified the following five primary computing disciplines, and recognized a category of computing disciplines that highlights the increasing number of hybrid or interdisciplinary courses of study.

- Computer Engineering(CE),
- Computer Science (CS),
- Information Technology (IT),
- Information Systems (IS),
- Software Engineering (SE),
- Mixed Disciplinary Majors (xx Informatics or Computational xx).

Usually, Electrical Engineering (EE) is considered to be closely related to computing.

CS spans a wide range of topics from theoretical and algorithmic foundations to cutting-edge applications such as Artificial Intelligence and Cybersecurity. SE is a sub-discipline of designing, developing, testing, and maintaining software systems. CS and SE typically require heavy coding and software development. IT is the application of computer technologies with a strong focus on practical and hands-on expertise to take care of computer systems and IT infrastructure. IS emphasizes the business side of information management. IT and IS typically require less coding. EE and CE focus more on hardware and cyber-physical systems. Figure 1 illustrates the relationship between CS, CE, IT, IS, SE, EE, and Cybersecurity. The proposed new B.S. in Cybersecurity degree sits between CS, SE and IT, with a focus on cybersecurity and a combination of theoretical foundation and practical, hands-on skills.

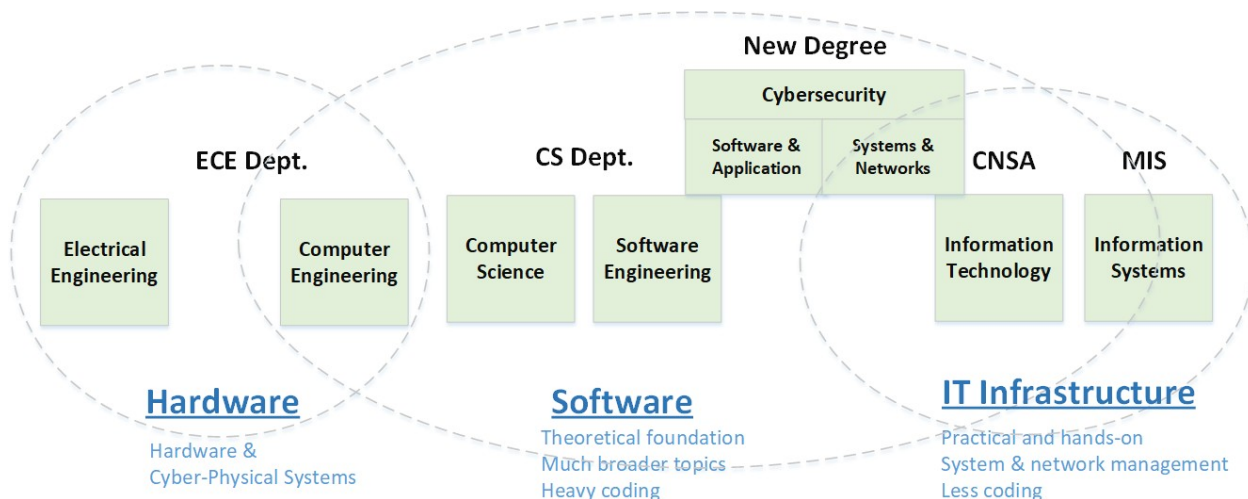


Figure 1: Relationship of EE, CE, CS, SE, CE, IT, IS and Cybersecurity

6.2 A quick explanation of cybersecurity:

Cybersecurity is a broad term that covers many different areas and disciplines. The ACM Cybersecurity Curricular Guidelines (CSEC 2017) defines cybersecurity as:

A computing-based discipline involving technology, people, information, and processes to enable assured operations in the context of adversaries. It involves the creation, operation, analysis, and testing of secure computer systems. It is an interdisciplinary course of study, including aspects of law, policy, human factors, ethics, and risk management.

Figure 2 illustrates the structure of the cybersecurity discipline.

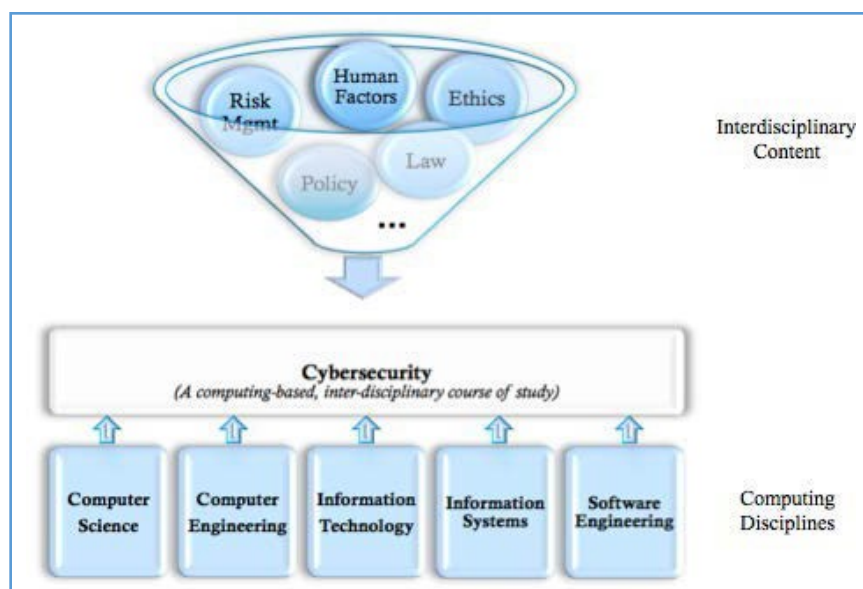


Figure 2. Structure of the cybersecurity discipline. (Source: <http://cybered.acm.org/>)

6.3 Enrollment trends:

The nationwide enrollment of computing degrees has more than tripled since 2006 and more than doubled since 2011 based on the CRA Taulbee Survey (Source: <https://cra.org/data/generation-cs/phenomenal-growth-cs-majors-since-2006/>). Figure 3 shows the average enrollment of CS majors at large and small academic units. Artificial intelligence/machine learning, software engineering, security/information assurance, networks, and databases are the most popular areas of specialization in computing (Source: <https://cra.org/wp-content/uploads/2018/05/2017-Taulbee-Survey-Report.pdf>). The proposed program aims to capitalize on the phenomenal growth of computing majors with an emphasis on security/information assurance, networks, and software engineering.

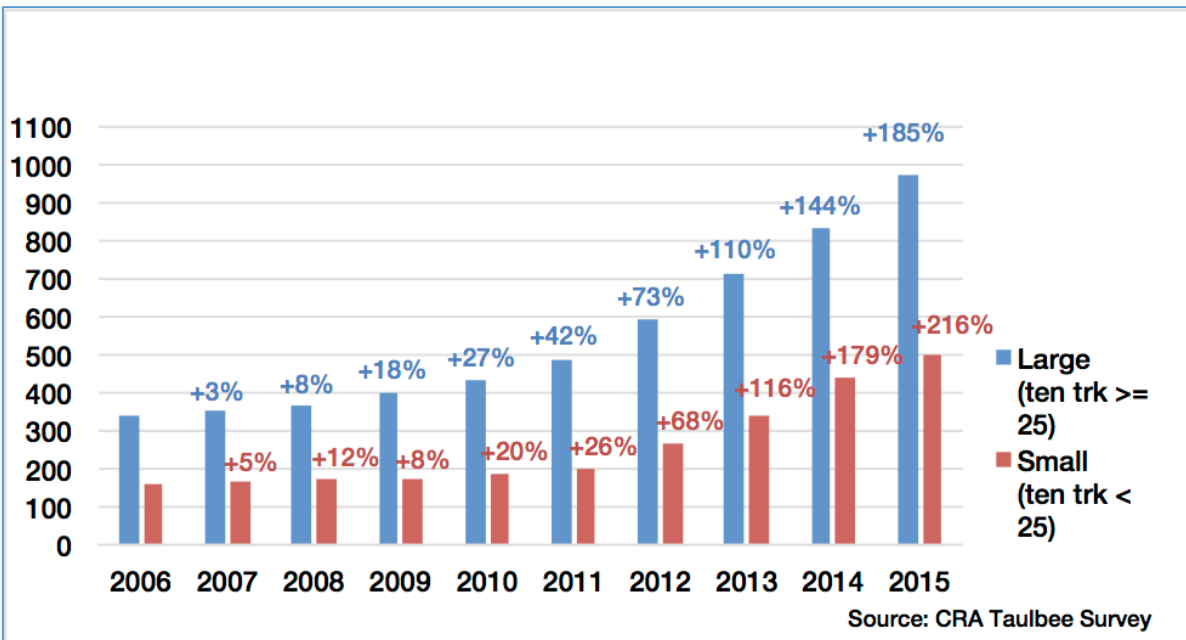


Figure 3: Average national enrollment of CS majors at large and small institutions.
(Source: <https://cra.org/data/generation-cs/phenomenal-growth-cs-majors-since-2006/>).

6.4 Job market:

People with cybersecurity skills are in great demand as the threat environment increasingly becomes more complex and challenging. In 2017, there were more than 300k unfilled cybersecurity jobs in the U.S. alone (Source: <https://www.comptia.org/about-us/newsroom/press-releases/2018/06/06/us-cybersecurity-worker-shortage-expanding-new-cyberseek-data-reveals>). And the global figure of unfilled cybersecurity openings was 1 million (Source: <http://www.cisco.com/c/dam/en/us/products/collateral/security/cybersecurity-talent.pdf>). The global demand for cybersecurity professionals will rise to 6 million by 2019, with a projected shortfall of 1.5 million (<http://cybersecurityventures.com/jobs/>). In addition, the ISACA report in 2017 indicated that less than 25% of cybersecurity job candidates were qualified (Source: https://www.isaca.org/cyber/Documents/state-of-cybersecurity_res_eng_0316.pdf). The need to have well-trained and well-prepared cybersecurity workforce is a pressing issue and one that Michigan Tech can help solve.

Figure 4 is a screenshot from the CyberSeek.com showing the current cybersecurity job supply/demand heat map in the U.S.

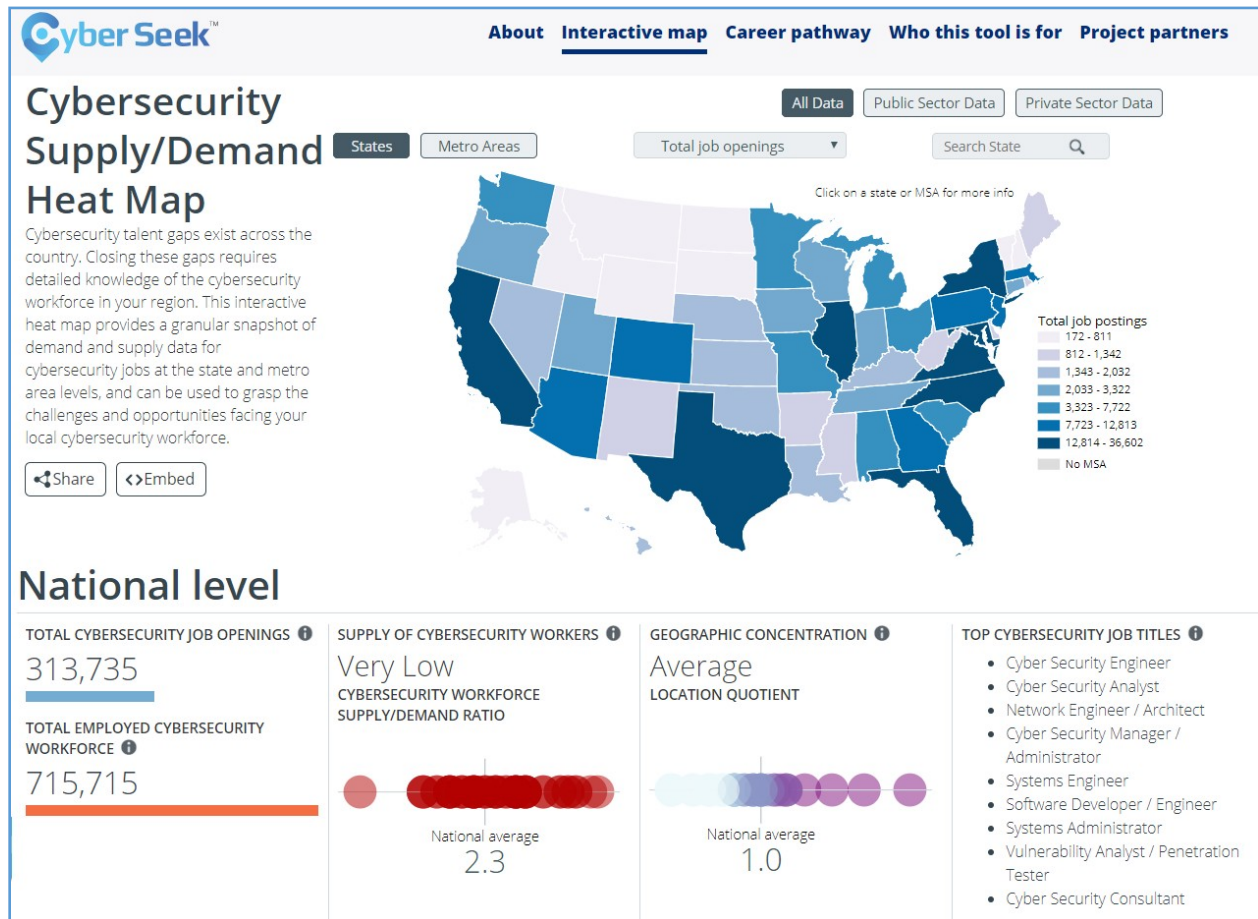


Figure 4: A screenshot of CyberSeek.com showing the current cybersecurity job supply/demand heat map in the U.S.

Figure 5 shows that 73% of new STEM occupations will be computing by 2020 based on US-BLS data (Source: <https://cse.sc.edu/job/73-new-jobs-stem-are-computing>). Graduates of the proposed B.S. in Cybersecurity can work in the following areas:

- Info security, web developer, network architect: 7%
- Network/system administrator: 9%
- System analyst: 12%
- Software developer: 30%

In conclusion, our students will be positioned to fit over 50% of all new STEM jobs.

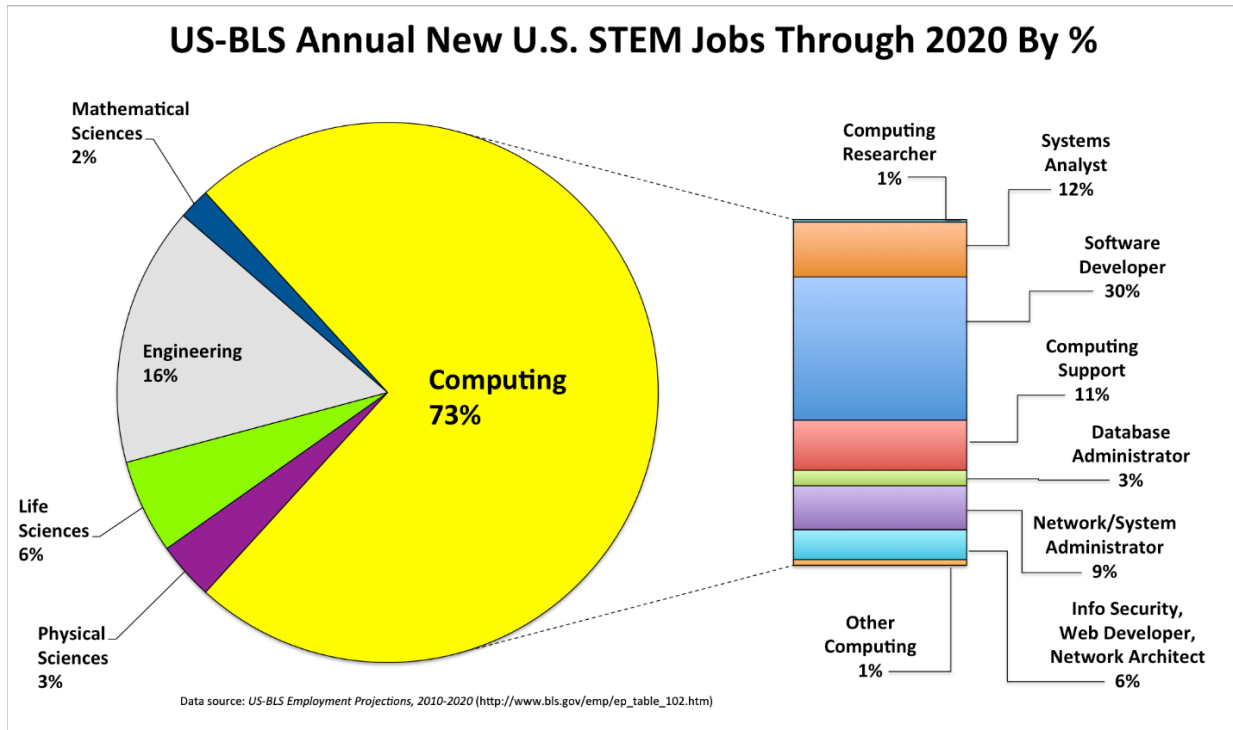


Figure 5. 73% of New STEM occupations will be computing by 2020
 (Source: <https://cse.sc.edu/job/73-new-jobs-stem-are-computing>)

6.5 University and School mission:

Michigan Tech is in the process of establishing a new Computing College starting in Fall 2019. The new college aims to catalyze Michigan Tech into an academic institution that reflects the technological, economic, and social realities of the modern era, often referred to as the Fourth Industrial Revolution. The proposed B.S degree in Cybersecurity is an integral part of the new college and is consistent with the mission of Michigan Tech and the new college.

7. Discussion of related programs within the institution and at other institutions

7.1 Security related courses at Michigan Tech:

There is no other undergraduate major on campus focused exclusively on cybersecurity. However, several departments and programs at Michigan Tech currently offer courses with relevance to the cybersecurity field. In addition, Michigan Tech offers a Master’s degree in Cybersecurity and a Minor in Cybersecurity.

Below is a summary of security-related courses (loosely defined) offered at Michigan Tech

- Department of Computer Science*
- CS 3141 Team Software Project

- CS 3331 Concurrent Computing
- CS 3411 Systems Programming
- CS 3712 Software Quality Assurance
- CS 4321 Introduction to Algorithms
- CS 4411 Operating Systems
- CS 4461 Computer Network
- CS 4471/5471 Computer Security
- CS 4710 Model Driven Software Development
- CS 4740 Development of Trusted Software
- CS 4711 Software Processes and Management
- CS 5000 National Cybersecurity Policy and Law

School of Technology

- SAT 2711 Linux System Administration
- SAT 3310 Scripting for Administration, Automation & Security
- SAT 3611 Infrastructure Service Administration & Security
- SAT 3812 Cybersecurity I
- SAT 3820 Wireless System Administration & Security
- SAT 4411 Data Center Engineering
- SAT 4812 Cybersecurity II
- SAT 4816/5816 Digital Forensics
- SAT 5111 Security and Privacy
- SAT 5241 Designing Security Systems
- SAT 5281 Healthcare Security Management
- SAT 5817 Security Penetration Testing & Audit

Department of Electrical and Computer Engineering

Department of Mechanical Engineering-Engineering Mechanics

- CS/EE 4723 Network Security
- EE 5315/MEEM5315 Cyber Security of Automotive Systems I
- EE 5451 Risk Management for Critical Infrastructure Protection
- EE 5455/MEEM5300 Cyber Security for Industrial Control Systems
- EE 5497 Multimedia Data Security in Hardware Firmware and Software
- EE 6320/MEEM6320 Cyber Security of Automotive Systems II

Mathematical Sciences

- MA 3203 Cryptography

MIS Program at the School of Business and Economics

- MIS 4200 Management of Cyber Security

Social Science

- SS 3640 Selected Topics in Cyber-Law

7.2 Security related education and research activities at Michigan Tech:

The Institute of Computing and Cybersystems (ICC) is the research arm of the Alliance for Computing, Information, and Automation (ACIA) and the new Computing College. It leads and promotes research and learning experiences in the areas of cybersecurity and cyber systems. ICC is composed of five centers; one of them focuses on cybersecurity. ICC currently has over \$8 million research funding and over 50 members from a number of departments and schools including the departments of Computer Science, Electrical and Computer Engineering, Mechanical Engineering, Civil Engineering, the School of Technology, and the School of Business and Economics.

Michigan Tech has applied for the National Center of Academic Excellence in Cyber Defense Education (CAE – CDE). The B.S. degree in CNSA is the identified CAE-CDE curriculum path. The Center for Cybersecurity under ICC is the CAE cyber center at Michigan Tech. The CAE-CDE program was established by the National Security Agency (NSA) and Department of Homeland Security (DHS) jointly to reduce vulnerability in national information infrastructure by promoting higher education and research in Information Assurance and Cyber Defense. The CAE designation is an institutional designation, and the benefits extend beyond the cyber defense program to the entire institution.

RedTeam is an on-campus student organization focused on cybersecurity. It exists to promote a security-driven mindset among the student population, and to provide a community and resource for those wishing to learn more about information security. The team has nearly 30 student members and meets every two weeks during the semester. Dr. Yu Cai and Dr. Bo Chen are the faculty advisors of RedTeam. In addition, there were several cybersecurity enthusiasts who participated in various national cybersecurity competitions including the National Cyber League (NCL) cybersecurity competition and the national CyberStart competition.

Michigan Tech will offer two GenCyber summer camps to local high school students and K-12 teachers during the summer of 2019. The goal of these camps is to increase interest in cybersecurity careers and diversity in the cybersecurity workforce of the nation, and help all students understand correct and safe online behavior and how they can be good digital citizens. The GenCyber camps are offered at no cost to all participants. Funding is provided jointly by the National Security Agency (NSA) and the National Science Foundation (NSF). There are other outreach activities including Women in Computer Science and several SYP camps on computing.

Dr. Yu Cai is the principal investigator of two NSA National Cybersecurity Curriculum Program (NCCP) grants. The goal of these projects is to integrate concepts and best practices of cybersecurity into undergraduate IT/Computing curricula. Dr. Cai and his team were recognized as featured curriculum authors as part of the NSA NCCP initiative. In 2017, NSA awarded grants to universities to build courses and modules in high need cybersecurity areas. All curriculum has undergone a strenuous multi-faceted review before being released. In the recognition note sent by the NSA NCCP program manager, it says “Curriculum developed by your institution has been released nationally in this unique and transformative effort as we work to secure our nation by strengthening the cyber workforce. We congratulate Cai and appreciate the institutional support provided to him for his hard work in developing this curriculum.”

Dr. Jean Mayo has been conducting research on developing pedagogical methods and supporting tools in two areas: cryptography and access control. This work centers on the use of visualization to improve student learning. Both projects were funded by NSF. Another NSF project focuses on secure programming using techniques from compiler design for the students to visualize insecure constructs in their programs. Moreover, Dr. Jean Mayo also conducts basic research achieving anonymity in peer-to-peer networks. An ongoing project is investigating the use of a firewall model of file system access control. This model allows access requests to be moderated on a number of attributes, both of a process and of the environment, in addition to user credentials.

Dr. Bo Chen’s research focused on applied cryptography and data security. He is dedicated to investigating novel techniques to protect sensitive data in mobile devices/flash storage media and cloud infrastructures. He has published in top computing conferences including a Distinguished Paper Award from the prestigious cybersecurity venue ACSAC ’17, a top AI venue AAAI’18, and a top cybersecurity venue ACM CCS ’17. Dr. Chen is the co-PI of two external grants on cybersecurity from NSA. Dr. Chen has been serving as the faculty coach for MTU NCL (National Cyber League) cyber competition team, and the co-advisor for MTU RedTeam group and the CS cybersecurity reading group. Under his supervision, a CS undergraduate student placed 17th out of 3,324 players in NCL cyber competition regular season during Fall 2018.

7.3 Discussion of related programs outside of Michigan Tech

In the next few sections, we will summarize our survey of related programs at Michigan and surrounding states (IN, IL, MN, OH, WI), as well as online programs. For simplicity and clarity, only Bachelor’s degrees will be listed. These degrees usually have keywords like cybersecurity, security, cyber defense, digital forensics, information assurance, and information security. General Computer Science, Computer Engineering, Information Technology, Computer Network, and System Management degrees without the above keywords will not be listed, even though some may have a strong security component. Other degree options such as minors, certificates, graduate degrees, associate degrees will not be listed either.

7.4 Related programs at the State of Michigan:

The State of Michigan is an up-and-comer in cybersecurity education. There are seven universities or colleges offering a B.S. degree in cybersecurity or in a similar name, as listed in Table 1.

Table 1: Related programs in Michigan

University	Related Degree (s)
Baker College	B.S. in Information Technology and Security B.S. in Cyber Defense
Davenport University	B.S. in Cyber Defense B.S. in Digital Forensics B.S. in Network Management and Security
Eastern Michigan University	B.S. in Information Assurance and Cyber Defense
Ferris State University	B.S. in Information Security and Intelligence
Northern Michigan University	B.S. in Information Assurance/Cyber Defense

University of Detroit Mercy	B.S. in Computer and Information Systems with a major in Cybersecurity
University of Michigan Dearborn	B.S. in Cybersecurity and Information Assurance B.S. in Digital Forensics

7.5 Related programs in the surrounding states:

There are also a few related programs in the five surrounding states of Michigan (IN, IL, MN, OH, WI), as listed in Table 2.

Table 2: Related programs in the surrounding states

State and # of related programs	University	Related Program (s)
Ohio: 1	Ohio State University	B.S. in Computer Science and Engineering – Information Security Focus
Wisconsin: 1	University of Wisconsin-Stout	B.S. in Applied Mathematics and Computer Science – Cyber Security Concentration
Minnesota: 2	Metropolitan State University	B.A.S. in Computer Forensics
	Rasmussen College	B.S. in Cyber Security
Illinois: 3	Northeastern Illinois University	B.S. in Computer Science – Computer Networks and Security concentration
	Roosevelt University	B.S. in Cyber and Information Security
	University of Illinois at Urbana-Champaign	B.S. in Computer Science (offering a strong cybersecurity focus)
Indiana: 5	Anderson University	B.A. in Information Security
	Indiana University Bloomington	B.S. in Informatics – Security Informatics Specialization
	Purdue University-Northwest	B.S. in Computer Information Technology (with a strong focus on cybersecurity)
	Purdue University	B.S. in Computer and Information Technology – Cybersecurity
	Taylor University	B.S. in Computer Science – Cybersecurity

7.6 Related online programs:

There are a number of related online programs nationwide. Some are offered by big names. Table 3 is a list of eight universities who offer a strong and reputable cybersecurity Bachelor’s degree online.

Table 3: Related online programs

University	Related Program (s)
Purdue University Global	B.S. in Cybersecurity
Pennsylvania State University-World Campus	B.S. in Security and Risk Analysis
George Mason University	B.A.S. in Cyber Security
Drexel University	B.S. in Computing and Security Technology
University of Arizona	B.A.S. in Cyber Operations
Kennesaw State University	B.S. in Cybersecurity Bachelor in Information Security and Assurance
Utica College	B.S. in Cybersecurity
Champlain College	B.S. in Cybersecurity B.S. in Computer Forensics

8. Projection of student enrollments

We recognize that the new degree program will enter a fast-growing market with fierce competition. However, Michigan Tech is well positioned to offer the new degree. First, Michigan Tech has a strong foundation in cybersecurity education and research activities. The cost to add a new cybersecurity degree is relatively low. Second, none of the four research universities in Michigan offer a similar degree. The four research universities include the University of Michigan – Ann Arbor, Michigan State University, Wayne State University, and Michigan Tech. Third, the new degree will enable Michigan Tech to offer a suite of computing degrees to students and help attract more prospective students. Fourth, Michigan Tech has strategically developed our expertise and curricula to be consistent with the NSA Center of Academic Excellence (CAE) requirements to be competitive on a national scale. Therefore, it is a natural move to establish a new B.S. degree in Cybersecurity at Michigan Tech.

Michigan Tech offers a Minor in Cybersecurity starting from Fall 2018. Table 4 shows the current enrollment of the minor. Even though this is the first year that Michigan Tech offers the minor, there are already 53 students enrolled.

Table 4: Enrollment of the Cybersecurity Minor

Student Major (Code for the Major)	Number of Students
Computer Engineering (ECP)	7
Computer Science (SCS)	10
Software Engineering (SEEN)	1
Computer Network and System Administration (TCSA)	35
Total	53

To address the competition issue and give time to allow the program to grow, we present a conservative enrollment projection informed by interest in our current Cybersecurity Minor, as illustrated in Table 5.

Table 5: Projection of three-year enrollment

New Enrollment in Year 1	New Enrollment in Year 2	New Enrollment in Year 3	Total New Enrollment in three years
15	20	25	60

9. Curriculum design

In addition to the general education requirements, students will take 36 credits for required core courses, 36 credits for concentration-specific core courses, 4 credits for the culminating experience (senior design, co-op or enterprise), and 6 credits for technical electives. The total credits for the degree are 121 plus 3 co-curricular units.

For the culminating experience, students can choose one from any of the following three options including senior design projects, co-ops, or enterprise programs. This will give students more flexibility and encourage them to obtain sufficient practical experience before graduation.

The new degree has the following two concentrations.

1) Software Security: In this concentration, students will learn to systematically design, develop, deploy and test trusted software and applications. Students will find and fix common software and application vulnerabilities to prevent attacks from exploiting them. Adopting best practices and techniques at each phase of the software development cycle is one of the key elements to strengthen the security of software systems and applications. If you enjoy coding and want to develop secure and trusted software systems, this is the right concentration for you!

2) System and Network Security: In this concentration, students will learn to manage and secure computer systems, networks, and IT infrastructure from unauthorized access, attacks, misuse, or damage by implementing various security processes, technologies, and best practices. Students will learn to combine multiple layers of defenses, implement security policies and controls, detect emerging threats before they infiltrate the network, and perform critical functions within a secure enterprise environment. If you prefer hands-on learning and want to secure IT systems and infrastructure, this is the right concentration for you!

9.1 Curriculum design of related programs:

Table 6 summarizes curriculum design of related programs and the proposed one. Most programs require 120 to 126 credit hours to earn a B.S. degree.

Table 6: Curriculum design of related programs

University	Related Program	Credit Hours	Curriculum
Purdue University	B.S. in Computer and Information Technology – Cybersecurity	120	Core courses: 60 Cr Cybersecurity electives: 6 Cr Other course Req: 54 Cr
Davenport University	B.S. in Cyber Defense	120	Core courses: 69 Cr Major electives: 12 Cr Open electives: 9 Cr General Ed and other Req: 30 Cr
Kennesaw State University	B.S. in Cybersecurity	123	Core courses: 63 Cr Major electives: 9 Cr Free electives: 9 Cr General Ed and other Req: 42 Cr
Eastern Michigan University	B.S. in Information Assurance and Cyber Defense	124	Core courses: 63 Cr Restricted electives: 21 Cr General Ed and other Req: 40 Cr
Ohio State University	B.S. in Computer Science and Engineering – Information Security Focus	126	Core courses: 57 Cr CS core choices: 20 Cr Technical electives: 17 Cr General Ed: 32 Cr
Michigan Technological University	B.S. in Cybersecurity <i>(Proposed)</i>	121	Core courses: 36 Cr Concentration core: 36 Cr Technical electives: 6 Cr Senior design/Co-op/Enterprise: 4 Cr General Ed: 39 Cr

9.2 List of Courses

Total credit hours: 121 plus 3 co-curricular units

9.2.A. Core Courses: Students must take all of the following courses. **(36 credits)**

- CS1121 (3) + CS1122 (3) Introduction to Programming I + II
- OR
- CS1131 (5) Accelerated Introduction to Programming

- CS2311 (3) Discrete Structure
- CS4000 (3) National Cybersecurity Policy and Law – **New Course**
- CS4510 (3) Risk Assessment & Incident Response – **New Course**
- CS/SAT4530 (3) Reverse Engineering & Malware Analysis – **New Course**
- CS/EE4723 (3) Network Security
- SAT1700 (3) Cyber Ethics
- SAT2711 (4) Linux Fundamentals

SAT3812 (3)	Cybersecurity I
SAT4816 (3)	Digital Forensics
MA2320 (2)	Elementary Linear Algebra

9.2.B. Core Courses in Concentrations: Students must take all courses in a concentration to fulfill the concentration requirement. **(36 credits)**

Software Security Concentration (36 credits)

CS1142 (3)	Programming at the Hardware Software Interface
CS2321 (3)	Data Structures
CS3141 (3)	Team Software Project
CS3331 (3)	Concurrent Computing
CS3421 (3)	Computer Organization
CS3425 (3)	Introduction to Database Systems
CS3411 (3)	System Programming
CS3712 (3)	Software Quality Assurance
CS4321 (3)	Introduction to Algorithms
CS4461 (3)	Computer Networks
CS4471 (3)	Computer Security
CS4740 (3)	Development of Trusted Software

System and Network Security Concentration (36 credits)

SAT2343 (4)	Network Administration I
SAT3210 (3)	Database Management
SAT3343 (4)	Network Administration II
SAT3611 (3)	Infrastructure Service Administration & Security
SAT3820 (4)	Wireless System Administration and Security
SAT4310 (3)	Advanced Scripting
SAT4411 (3)	Data Center Engineering
SAT4520 (3)	Machine Learning in Cybersecurity – New Course
SAT4812 (3)	Cybersecurity II
SAT4817 (3)	Security Penetrating Test & Audit– New Course
OSM4300 (3)	Project Management

9.2.C. Culminating Experience: Students can choose one from any of the following three options: senior design projects, co-ops, or enterprise programs. All these activities should be preapproved and include a significant cybersecurity experience **(4 credits)**.

CS/SAT4793 (2) + CS/SAT4794 (2)	Senior Design I + II	- New Courses
OR		
UN3002 (2) + UN3003 (2)	Undergraduate Cooperative Education I + II	
OR		
ENT4950(2)+ENT4960(2)	Enterprise Project Work	

9.2.D. Technical Elective Courses: Students can take any of the following courses for technical electives. **(6 credits)**

CS3000 – CS5999

SAT3000 – SAT5999

EE3000 – EE5999

ENT3950(1) and ENT3960(1)

HU3120 (3) Technical & Professional Communication

SS3640 (3) Selected Topics in Cyber-Law

MIS4200 (3) Management of Cyber Security

OSM4300 (3) Project Management

Requests to take graduate-level courses or to waive pre-requisites will be approved by the course instructor, the academic advisor, and the undergraduate director on a case by case basis.

9.2.E. General Education Requirements: Students must take the following courses to fulfill other General Education requirements. **(39 credits plus 3 co-curricular units)**

Gen Ed Core Requirements (12 credits):

UN 1015 (3), UN 1025 (3), Critical and Creative Thinking (3), Social Responsibility & Ethical Reasoning (3)

Gen Ed HASS Requirements (12 credits):

Communication and Composition (3), Humanities and Fine Arts (3), Social and Behavioral Sciences (3), HASS Elective (3)

Gen Ed STEM Requirements (15 credits):

Science Elective with lab (4), Science Elective (3)

MA1160(4) OR MA1161(5) Calculus with Technology I OR Calculus Plus w/ Technology I

MA2720(4) Statistical Methods

Co-curricular Requirements (3 semester units = 3 credits)

10. New course descriptions

10.1 New courses for the degree

The B.S. in Cybersecurity degree can be offered with the addition of the following new courses. CS4510, SAT4520, and CS/SAT4530 are newly designed courses. CS/SAT4793 and CS/SAT4794 are new senior design courses. CS4000 and SAT4817 are dual-listed courses of existing graduate-level courses.

1) CS4510 Risk Assessment & Incident Response

Short title: Risk Asmt and Incident Rspns

Course description: Study of risk assessment models and methodologies, incident response and handling, related policies and best practices. Topics include risk analysis, risk management models and processes, risk mitigation economics, communication of risk, incident response, incident identification and containment, and incident handling lifecycle.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring

Prerequisite(s): SAT2711 and SAT3812

Restrictions:

This is a required core course for both concentrations.

2) SAT4520 Machine Learning in Cybersecurity

Short title: Machine Learning in Security

Course description: Study of artificial intelligence and machine learning in cybersecurity. Topics include fundamentals of common machine learning and deep learning algorithms, intelligent threat detection and analysis, user behavior analytics, machine learning in hacking, and automated cybersecurity systems.

Credits: 3.0

Lec-Rec-Lab: (0-2-2)

Semesters Offered: Fall

Prerequisite(s): SAT3812 and SAT4310

Restrictions:

This is a required core course for the System and Network Security concentration.

3) CS/SAT4530 Reverse Engineering & Malware Analysis

Short title: Reverse Engr and Malware Anlys

Course description: Study of software and hardware reverse engineering and malware analysis. Topics include principles of reverse engineering, reverse engineering tools and techniques, sandboxing, simulation methods and instrumentation, anti-reverse engineering techniques, static malware analysis, dynamic analysis, threat analysis, and automated analysis.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring

Prerequisite(s): SAT3812 and (CS3411 or SAT4310)

Restrictions:

This is a required core course for both concentrations.

4) CS/SAT4793 Senior Design I

Course description: Capstone course requiring the application of knowledge gained in lower division courses. Projects are team oriented, require weekly progress reports, and culminate with a final report and oral presentation.

Credits: 2.0

Lec-Rec-Lab: (0-0-6)

Semesters Offered: Fall, Spring, Summer

Prerequisite(s): SAT3812

Restrictions: Must be enrolled in one of the following Major(s): Cybersecurity; Must be enrolled in one of the following Class(es): Senior

5) CS/SAT4794 Senior Design II

Course description: Capstone course requiring the application of knowledge gained in lower division courses. Projects are team oriented, require weekly progress reports, and culminate with a final report and oral presentation.

Credits: 2.0

Lec-Rec-Lab: (0-0-6)

Semesters Offered: Fall, Spring, Summer

Prerequisite(s): CS4793 or SAT4793

Restrictions: Must be enrolled in one of the following Major(s): Cybersecurity; Must be enrolled in one of the following Class(es): Senior

The CNSA program has two 3-credit senior design courses SAT4480 and SAT4880. The CS department has two 3-credit senior design courses CS4791 and CS4792. The proposed senior design courses are similar except only for 2 credits. Senior design projects will be jointly managed by CNSA faculty and CS faculty.

6) CS4000 National Cybersecurity Policy and Law

Short title: Cybersecurity Policy and Law

Course description: This course introduces the role of government in securing cyberspace. Students learn the basic national cybersecurity policy and law. Topics include federal, state, and local entities involved in cybersecurity, relevant laws and regulations, concepts of civil liberties, intellectual property, and privacy, and national security.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall

Prerequisite(s): SAT3812

Restrictions:

This is a dual-listed course of CS5000 National Cybersecurity Policy and Law. It is a required core course for both concentrations.

7) SAT4817 Security Penetration Testing & Audit

Short title: Sec Penetration Test and Audit

Course description: To provide knowledge and demonstrated methods to help prevent security breaches and develop safeguards to protect sensitive information and confidential data. Primary focus will be on the healthcare sector. Students learn offensive and defensive security concepts, audit best-practices.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring - Offered alternate years

Prerequisite(s): SAT3812

Restrictions:

This is a dual-listed course of SAT5817 Security Penetration Testing & Audit. It is a required core course for the System and Network Security concentration.

10.2 Establishing a Cybersecurity Enterprise program

To offer students more options for the culminating experience, we plan to establish and advise a Cybersecurity Enterprise program. Since this effort requires a significant amount of time from the faculty advisor, one course workload reduction throughout the year will be requested for the faculty advisor.

Currently, there are two related enterprise programs on campus. However, none of them are specifically designed for cybersecurity. Blue Marble Security (BMS) Enterprise a large enterprise that focuses on securing the future through the thoughtful use of technology. BMS defines “national security” through the provision of technical support to the defense, the corporate economy, and the personal well-being of the country and all its people. ITOxygen is another enterprise that specializes in information technology (IT) for student organizations and businesses, with a focus on developing information systems and IT solutions. Topics include systems and information analysis, software development, database design, and web-based application development.

The new Cybersecurity Enterprise will be a student-led enterprise that focuses on cybersecurity and its application in different disciplines. Areas of interest include red team / blue team, hackathon, penetration test, software and application security, network and system security, security in cyber-physical systems and autonomous vehicles. The new enterprise will also sponsor student participation of local and national cybersecurity competitions including the National

Collegiate Cyber Defense Competition (CCDC) and National Cyber League (NCL) cybersecurity competition.

10.3 New Course Add Forms

New Course Add Forms are attached in Appendix C

10.4 Changes to existing courses:

There are changes to some existing courses as listed below:

- 1) CS/EE4723 Network Security: change Pre-Requisite(s) to EE 4272 or CS 4461 or SAT4812
- 2) SAT2711 Linux System Administration: rename to SAT2711 Linux Fundamentals.
Add additional content: Fundamental OS concepts, OS design principles, and an introduction to cyber ethics.
- 3) SAT4310 Advanced Scripting: change from on-demand to Fall offering
- 4) SAT3812 Cybersecurity I: change from Fall/Summer offering to Spring/Summer offering.
Change restrictions to: Must be enrolled in one of the following Class(es): sophomore, Junior, Senior
- 5) SAT4411 Data Center Engineering: change Pre-Requisite(s) to SAT 3611 and (SAT 3200 or SAT3210)

Changes on existing courses will be entered into the registrar systems once the new degree is approved. A permanent change will take place during the binder process in Fall 2019 for the year 2020 and after.

11. Model schedule demonstrating completion time.

Total credits = 121 plus 3 co-curricular units

(THE FOLLOWING SPACE IS INTENTIONALLY LEFT BLANK)

For the Concentration of Software Security (121 plus 3 co-curr units)

Fall Year 1 (16 Cr)		
Course	Credit	Requirement
UN 1015	3	Gen Ed Core
CS1121 or CS1131 Intro to Programming I or Accelerated Intro	3 or 5	Major
SAT1700 Cyber Ethics	3	Major
MA1160 or MA1161 Calculus with Technology I or Calculus Plus	4 or 5	Gen Ed STEM
Critical and Creative Thinking	3	Gen Ed Core
Spring Year 1 (15 Cr)		
UN 1025	3	Gen Ed Core
CS1122 Introduction to Programming II	3	Major
CS2311 Discrete Structure	3	Major
MA2320 Elementary Linear Algebra	2	Major
Science Elective (with lab)	4	Gen Ed STEM
Fall Year 2 (17 Cr)		
SAT2711 Linux Fundamentals	4	Major
CS1142 Programming at the Hardware Software Interface	3	Concentration
CS2321 Data Structures	3	Concentration
MA2720 Statistical Methods	4	Gen Ed STEM
Science Elective	3	Gen Ed STEM
Spring Year 2 (15 Cr)		
SAT3812 Cybersecurity I	3	Major
CS3141 Team Software Project	3	Concentration
CS3421 Computer Organization	3	Concentration
Social Responsibility & Ethical Reasoning	3	Gen Ed Core
Humanities and Fine Arts	3	Gen Ed HASS
Fall Year 3 (15 Cr)		
CS3331 Concurrent Computing	3	Concentration
CS3411 System Programming	3	Concentration
CS3425 Introduction to Database Systems	3	Concentration
Social and Behavioral Sciences	3	Gen Ed HASS
Communication and Composition	3	Gen Ed HASS
Spring Year 3 (15 Cr)		
CS4510 Risk Assessment & Incident Response	3	Major
CS3712 Software Quality Assurance	3	Concentration
CS4461 Computer Networks	3	Concentration
CS4321 Introduction to Algorithms	3	Concentration
Technical Elective	3	
Fall Year 4 (14 Cr)		
CS4000 National Cybersecurity Policy and Law	3	Major
SAT4816 Digital Forensics	3	Major
CS4471 Computer Security	3	Concentration
Technical Elective	3	
Senior Design or Co-op or Enterprise	2	
Spring Year 4 (14 Cr)		
CS/SAT4530 Reverse Engineering & Malware Analysis	3	Major
CS/EE4723 Network Security	3	Major
CS4740 Development of Trusted Software	3	Concentration
HASS Elective	3	Gen Ed HASS
Senior Design or Co-op or Enterprise	2	

For the Concentration of System and Network Security (121 plus 3 co-curr units)

Fall Year 1 (16 Cr)		
Course	Credit	Requirement
UN 1015	3	Gen Ed Core
CS1121 or CS1131 Intro to Programming I or Accelerated Intro	3 or 5	Major
SAT1700 Cyber Ethics	3	Major
MA1160 or MA1161 Calculus with Technology I or Calculus Plus	4 or 5	Gen Ed STEM
Critical and Creative Thinking	3	Gen Ed Core
Spring Year 1 (15 Cr)		
UN 1025	3	Gen Ed Core
CS1122 Introduction to Programming II	3	Major
CS2311 Discrete Structure	3	Major
MA2320 Elementary Linear Algebra	2	Major
Science Elective (with lab)	4	Gen Ed STEM
Fall Year 2 (15 Cr)		
SAT2711 Linux Fundamentals	4	Major
SAT2343 Network Administration I	4	Concentration
MA2720 Statistical Methods	4	Gen Ed STEM
Science Elective	3	Gen Ed STEM
Spring Year 2 (17 Cr)		
SAT3812 Cybersecurity I	3	Major
SAT3343 Network Administration II	4	Concentration
SAT3820 Wireless System Administration and Security	4	Concentration
Social Responsibility & Ethical Reasoning	3	Gen Ed Core
Communication and Composition	3	Gen Ed HASS
Fall Year 3 (15 Cr)		
SAT3210 Database Management	3	Concentration
SAT3611 Infrastructure Service Administration and Security	3	Concentration
SAT4310 Advanced Scripting	3	Concentration
OSM4300 Project Management	3	Concentration
Social and Behavioral Sciences	3	Gen Ed HASS
Spring Year 3 (15 Cr)		
CS4510 Risk Assessment & Incident Response	3	Major
SAT4411 Data Center Engineering	3	Concentration
SAT4812 Cybersecurity II	3	Concentration
SAT4817 Security Penetration Testing & Audit	3	Concentration
Technical Elective	3	
Fall Year 4 (14 Cr)		
CS4000 National Cybersecurity Policy and Law	3	Major
SAT4816 Digital Forensics	3	Major
SAT4520 Machine Learning in Cybersecurity	3	Concentration
Humanities and Fine Arts	3	Gen Ed HASS
Senior Design or Co-op or Enterprise	2	
Spring Year 4 (14 Cr)		
CS/SAT4530 Reverse Engineering & Malware Analysis	3	Major
CS/EE4723 Network Security	3	Major
HASS Elective	3	Gen Ed HASS
Technical Elective	3	
Senior Design or Co-op or Enterprise	2	

12. Library and other learning resources

The current library and other learning resources including journals, electronic databases, government documents, access to interlibrary loan services, and studying room, are sufficient to support this program. No additional library and learning resources are requested.

13. Description of available/needed equipment

The CNSA program at the School of Technology, the Computer Science Department, and the Electrical and Computer Engineering Department are well equipped with modern education and research laboratories:

<http://www.mtu.edu/technology/about/labs/>

<http://www.mtu.edu/cs/facilities/labs/>

<http://www.mtu.edu/ece/research/focus/>

No additional equipment is required for this program.

14. Program costs

The need for advising will be met by the current academic advisors at the School of Technology and the CS department.

One new full-time lecturer will be hired for this program. This need has been included in planning with the Computing College for the 2019-2020 academic year. The new lecturer will work with CNSA and CS faculty to develop and teach the three new courses (CS4510, SAT4520, CS/SAT4530), establish and manage the cybersecurity enterprise program (one course workload reduction throughout the year), and cover additional offering of one existing course (SAT4310). The new senior design courses (CS/SAT4793, CS/SAT4794) will be jointly managed by CNSA faculty and CS faculty. The new dual listed courses (CS4000, SAT4817) will be covered by the existing instructors.

Additional faculty lines will be requested based on the 30:1 student/faculty ratio as the program grows.

15. Accreditation requirements

The proposed B.S. in Cybersecurity degree is designed to follow the ACM Cybersecurity Curricular Guidelines (CSEC 2017) and National Institute of Standards and Technology (NIST) National Initiative for Cybersecurity Education (NICE) Workforce Framework. The goal is to be compliant with the Accreditation Board for Engineering and Technology (ABET) Cybersecurity

accreditation criteria and the NSA Center of Academic Excellence in Cyber Defense (CAE-CD) requirement.

15.1 ACM CSEC 2017

The ACM Cybersecurity Curricular Guidelines is the latest curriculum guidelines for post-secondary degree programs in cybersecurity. The official website is <http://cybered.acm.org/> .

CSEC 2017 lists the following eight knowledge areas:

1. Data Security
2. Software Security
3. Component Security
4. Connection Security
5. System Security
6. Human Security
7. Organizational Security
8. Societal Security

15.2 NIST NICE Framework

The NIST NICE Cybersecurity Workforce Framework establishes a taxonomy and common lexicon that describes cybersecurity work and workers irrespective of where or for whom the work is performed. The official website is:

<https://www.nist.gov/itl/applied-cybersecurity/nice/resources/nice-cybersecurity-workforce-framework>

The NICE Framework lists the following seven workforce categories:

1. Security Provision
2. Operate and Maintain
3. Oversee and Govern
4. Protect and Defend
5. Analyze
6. Collect and Operate
7. Investigate

15.3 ABET Accreditation

In 2018, the Computing Accreditation Commission (CAC) of ABET approved new accreditation criteria for undergraduate cybersecurity programs. The ABET CAC Accreditation Criteria for 2019-2020 can be found here:

<https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-computing-programs-2019-2020/#2>

The ABET Cybersecurity Accreditation Criteria have the following curriculum requirements.

The curriculum requirements specify topics, but do not prescribe specific courses. These requirements are:

(a) At least 45 semester credit hours (or equivalent) of computing and cybersecurity course work. The course work must include: Application of the crosscutting concepts of confidentiality, integrity, availability, risk, adversarial thinking, and systems thinking.

2. Fundamental topics from each of the following:

Data Security: protection of data at rest, during processing, and in transit.

Software Security: development and use of software that reliably preserves the security properties of the protected information and systems.

Component Security: the security aspects of the design, procurement, testing, analysis, and maintenance of components integrated into larger systems.

Connection Security: security of the connections between components, both physical and logical.

System Security: security aspects of systems that use software and are composed of components and connections.

Human Security: the study of human behavior in the context of data protection, privacy, and threat mitigation.

Organizational Security: protecting organizations from cybersecurity threats and managing risk to support successful accomplishment of the organizations' missions.

Societal Security: aspects of cybersecurity that broadly impact society as a whole.

Advanced cybersecurity topics that build on crosscutting concepts and fundamental topics to provide depth.

b. At least 6 semester credit hours (or equivalent) of mathematics that must include discrete mathematics and statistics.

15.4 NSA CAE-CD

The NSA Center of Academic Excellence in Cyber Defense (CAE-CD) program was established by NSA and DHS jointly to reduce vulnerability in national information infrastructure by promoting higher education and research in Information Assurance/Cyber Defense (IA/CD), and to produce a growing number of professionals with expertise in the cybersecurity discipline. The official website can be found here:

<https://www.nsa.gov/resources/students-educators/centers-academic-excellence/>

The NSA CAE-CD program has a list of specific requirements on curriculum, faculty, students, research activities, outreach activities, and institutional support. The program requires the mapping of the institution's curriculum to the requisite Foundational, Core (5 Technical or 5 Non-Technical), and Optional Knowledge Units (KUs) at either the Bachelor, Master, or Doctoral level as outlined on page 4 of this document:

https://www.iad.gov/NIETP/documents/Requirements/CAE-CD_2019_Knowledge_Units.pdf

In addition, the institution needs to demonstrate that a student can reasonably complete the necessary course of study to include all KUs identified.

15.5 Current accreditation and the future plan

The CNSA program and the degree programs at the ECE department are accredited by ABET. Degree programs at the CS department plan to seek ABET accreditation in 2019 - 2020. Michigan Tech has applied for the NSA CAE-CD designation in Fall 2018. The B.S. degree in CNSA is the identified CAE-CD curriculum path.

We will seek ABET accreditation of the B.S. in Cybersecurity degree program after the first student graduates, a requirement for seeking ABET accreditation.

The NSA CAE-CD eligibility requirement is listed below:

“The Cyber Defense (CD) curriculum path must have been in existence for at least 3 years. Evidence must show one (1) year of student granted degrees with curriculum program path completion identified.”

We will seek NSA CAE-CD designation when the program meets the eligibility requirement.

16. Planned implementation date

Fall 2019

Appendix A: Additional requirements for new degree programs

1. Program-specific policies, regulations, and rules

The program will follow all existing university policies, regulations, and rules. There are no program-specific policies, regulations, and rules.

2. Scheduling plans

Regular

3. Space

The School of Technology and the ECE department are located in the EERC building. The CS department is located in the Rekhi building. There is classroom and laboratory space for classes, labs, computing equipment, and faculty offices. Space is sufficient to meet the needs of this program.

4. Faculty resumes

See links below:

<https://www.mtu.edu/technology/undergraduate/cnsa/faculty/>

<https://www.mtu.edu/cs/department/faculty-staff/>

<https://www.mtu.edu/ece/department/faculty/>

5. Information required for financial review

See Appendix B.

Appendix B: Criteria for Financial Evaluation of Proposed Academic Programs

1. Relation to University Strategic Plan

a. Relation of the program to the university's educational and research goals.

The proposed program supports the education goal of the University Strategic Plan, “Provide a distinctive and rigorous action-based learning experience grounded in science, engineering, technology, business, sustainability, and an understanding of the social and cultural contexts of our contemporary world.”

More specifically, the new program supports student learning by developing “new offerings in emerging disciplinary and interdisciplinary areas.” and by expanding “programs in response to social and economic needs and challenges.”

b. Consistency with the university's resource allocation criteria.

The proposed program should support the university budget in several ways. First, it is intended to attract new students to the university. Second, the program is an integral part of the new Computing College which is one of the most critical initiatives at the university level. Third, the new degree can be offered at a relatively low cost by building on top of the existing programs and resources.

2. Impact on University Enrollment

a. Projected number of students in the program.

We recognize that the new degree program will enter a fast-growing market with fierce competition. we project a conservative annual enrollment of 15 - 25 new students for the first three years.

b. Source of new students; in particular, will the students be drawn from existing programs, or will they be students who would otherwise not have come to Tech?

Based on the study of national trends and related programs in Michigan and the surrounding states , it is expected that the program will attract many new students to Michigan Tech.

Meanwhile, we anticipate that some students may transfer from CS and CNSA majors. These are usually students with strong interest in cybersecurity. The proposed new major would help retain these students at Michigan Tech by providing them with additional options. There are 7 related

Bachelor's degrees in Michigan and 12 degrees in the surrounding states. Some students looking for a career in cybersecurity may transfer to other universities if Michigan Tech fails to offer this degree.

For students who are not in the CS or CNSA majors (such as Computer Engineering or Electrical Engineering majors), they are likely to gravitate to the minor in cybersecurity.

Therefore, this program is expected to increase new enrollment as well as help retention by providing students with additional options on cybersecurity.

c. What is the likely correlation between demand for the new program and existing enrollment patterns at Michigan Tech?

This program is in a rapidly growing discipline. Therefore, it is reasonable to predict that the enrollment will continue to grow.

d. What is the current enrollment in the unit?

In Fall 2018, there were 83 undergraduates in the CNSA program and 489 undergraduates in the CS department.

3. Assessment.

This program will be assessed as part of the ongoing University assessment program. All of the University learning goals will be addressed by one or more classes in the proposed program. Additional assessment will be conducted to meet ABET accreditation criteria.

4. Discuss impact on resources required by department in which the program is housed.

a. Faculty lines.

One full-time lecturer is requested.

Additional faculty lines will be requested based on the 30:1 student/faculty ratio as the program grows.

b. Faculty and student labs, including ongoing maintenance.

Existing computer labs, including hardware and software, are adequate to support the program.

c. Advising.

The current resources for advising within the School of Technology and the CS department will be adequate.

5. Discuss impact on resources required by other units within the university.

a. Impact on other classes:

The program will utilize a number of existing courses from the CNSA program, the CS department, and the ECE department. We expect that the capacity at the CNSA program and the ECE department is adequate to serve the students in the new major. However, due to the significant enrollment increase in CS during the past few years, the CS department has a history of offering overly crowded classes. This problem is an extremely high priority item with the new Computing College administration such that additional resources will be allocated with the launch of the new Computing College.

b. For high demand fields, will it be possible to fill allocated faculty lines?

Cybersecurity is a high demand field. However, we should be able to fill the allocated faculty line with a national search. If the faculty line is not filled in the 1st year, we will continue the search in the 2nd year.

c. Has the department initiated any other new degree programs in the last five years?

The CS department, the CNSA program, and the ECE department jointly proposed a Minor in Cybersecurity in 2018, and a Master of Science Degree Program in Cybersecurity in 2016.

A Master of Science in Data Science degree was proposed as a non-departmental degree in 2014.

The CS department proposed a new Concentration in Game Development within the Bachelor's Degree in Computer Science in 2016, and another Concentration in Computer Systems (B.S. in C.S.) in 2015.

The ECE department proposed a Concentration in Electric Power Engineering as part of the degree Bachelor of Science in Electrical Engineering in 2017, a Concentration in Environmental Applications (B.S. in E.E.) in 2015, and a Concentration in Biomedical Application (B.S. in E.E.) in 2015.

Computing is a fast-growing discipline with frequent radical changes. It should not be surprised that new computing degrees were proposed within the past five years.

d. How do the benefits from this program compare to other alternatives that are currently under consideration or development?

This program will not require a significant allocation of resources. Therefore, we believe that it should not preclude the development of other programs. On the contrary, the new program will

allow Michigan Tech to offer a suite of computing degrees which will improve enrollment and retention.

6. Discuss departmental budget contribution

a. What is the department's total general fund budget?

For the CS department

Dept. budget: \$2,702,025
Salaries with fringes: \$2,685,449
Summer teaching return: summer 2018 \$54,000

For the School of Technology

School budget: \$ 2,948,023
Salaries with fringes: \$ 2,837,598
Summer teaching return: summer 2018 \$ 16,467

b. How much tuition does the department generate?

Based on data provided by Institutional Analysis.

For the CS department

Credit hours: AY 2017-18 graduate level: 840 undergraduate level 9,247 (total 10,087)

Graduate tuition generated by credit hours: \$1143 per credit: $840 \times 1143 = \$960,120$

Undergraduate tuition generated by credit hours: Using resident rates, $\$579 \times 9247 = \$5,354,013$

Funded Proposals
2016 \$3,089,337
2017 \$1,372,621
2018 \$959,991

For the School of Technology

Credit hours: AY 2017-18 undergraduate level 6,303

Undergraduate tuition generated by credit hours: Using resident rates, $\$579 \times 6303 = \$3,649,437$

Funded Proposals:
2017 - 2018: \$1,574,502

Appendix C: New Course Add Forms

Below is a list of new courses added for the B.S. in Cybersecurity degree. Detailed new course descriptions can be found in Section 10 of this proposal.

- 1) CS4510 Risk Assessment & Incident Response
- 2) SAT4520 Machine Learning in Cybersecurity
- 3) CS/SAT4530 Reverse Engineering & Malware Analysis
- 4) CS/SAT4793 Senior Design I
- 5) CS/SAT4794 Senior Design II
- 6) CS4000 National Cybersecurity Policy and Law
- 7) SAT4817 Security Penetration Testing & Audit

Course 1, 2 and 3 are newly designed courses. Course 4 and 5 are new senior design courses. Course 6 and 7 are dual-listed courses of existing graduate-level courses.



— Course Add Proposal — PLEASE COMPLETE THIS FORM IN RED

A guide for completing this form is located at <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>

1) Course Information

Is this a **half-semester course proposal**? Yes No

NOTE: All half-semester courses must follow rules set in Faculty Senate Proposal 4-00. See Senate website for details:
<http://www.sas.it.mtu.edu/usenate/propose/03/10-03.htm>

Course Prefix/Number (i.e. MEEM 2110): CS4510

Course Title (abbreviated; used on transcript - Up to 30 characters including spaces)

Risk Asmt and Incident Rspns

Alternative Title for Catalog (Up to 100 characters including spaces)

Risk Assessment & Incident Response

2) Credits

Number of credits assigned to this course ³ _____

OR

Range of credits if variable to (Number of credits to be taken in a given semester)

3) Schedule

Contact Hours per Week (Lec & Rec: 1 credit = 1 contact hour; Lab: 1 credit = 1-3 contact hours. (i.e. a 3-credit course may be 2 contact hours of lecture or recitation and up to 3 contact hours of lab OR 1 contact hour of lecture or recitation and up to 6 contact hours of lab))

3

Lecture

Recitation

Lab

OR

Research Course? Yes No

OR

Special Topics Course? Yes No

4) Additional Credits

May students receive **additional credits** by taking and passing this course more than once?

No

Yes, for a maximum of _____ credits. (Must be a multiple of the course credits, i.e. Research or Special Topics)

Yes, for an unlimited number of credits. (i.e. Music, Varsity sports, etc.)

5) Pass/Fail

Will this course be offered as a **pass/fail option ONLY?** (*grade of Sor E*) Yes No

6) Cross Listed/Equivalent Course

Cross Listed: Is there an identical course offered in a different subject or at a different level? Yes No

If **yes**, what is the other subject and course number? _____

Equivalent Course: Does this course replace a dropped course with no change in course content for degree requirements, prerequisites, and repeating purposes? Yes No

If **yes**, what is the subject and course number of the dropped course? _____

7) Corequisites and Prerequisites

Corequisites are courses that are **REQUIRED to be taken at the SAME TIME** as this course (courses **MUST** be offered during the same term):

Required corequisite course(s): _____ _____

Prerequisites are courses that are **REQUIRED to be taken PRIOR** to enrollment in this course. **Select appropriate box and use parentheses where needed.**

Required prerequisite course(s): 1_ SAT2711 <input checked="" type="checkbox"/> And <input type="checkbox"/> Or 2_ SAT3812 <input type="checkbox"/> And <input type="checkbox"/> Or 3_ _____ <input type="checkbox"/> And <input type="checkbox"/> Or 4_ _____ <input type="checkbox"/> And <input type="checkbox"/> Or 5_ _____ <input type="checkbox"/> And <input type="checkbox"/> Or 6_ _____
--

A **concurrent prerequisite** is a defined prerequisite course (from list above) that **MAY** be taken **EITHER** simultaneously in the same semester **OR** in a prior semester. Indicate below applicable courses.

Concurrent prerequisite course(s): _____ _____ _____

8) Catalog Course Description

The traditional catalog style description for a course is limited to **350 characters including spaces**. If course is proposed as a half-semester course, please include that information in the description. **Please refer to the Course Proposal Guide for examples and suggestions on developing a course description.**

Study of risk assessment models and methodologies, incident response and handling, related policies and best practices. Topics include risk analysis, risk management models and processes, risk mitigation economics, communication of risk, incident response, incident identification and containment, and incident handling lifecycle.

9) Registration Restrictions

- If permission is **always required** for registration purposes (a student cannot enter the course without department or instructor signature), please select the appropriate permission.

Do not select unless EVERY STUDENT must get "SIGNED INTO" the class.

Department **OR** Instructor

- Students who register for this course may be restricted by their **College/School OR** their **Major**. Please indicate if any college or major restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

No College/School Restrictions

No Major Restrictions

Colleges/Schools who MAY NOT enroll
(EXCLUDE)

-OR-

Colleges/Schools who MAY enroll (INCLUDE)

Majors that MAY NOT enroll
(EXCLUDE)

-OR-

Majors that MAY enroll (INCLUDE)

-- Restrictions continued on next page --

- A restriction may also be placed on **Class Standing** (freshman, sophomore, junior, senior, graduate). Please indicate if any class restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

No Class Restrictions

Class of students who MAY NOT enroll (EXCLUDE) _____ -OR- Class of students who MAY enroll (INCLUDE) _____

10) Semester(s) Offered

Fall Spring Summer *(Check all that apply)*

OR On Demand

If offered in a specific semester, will the course be offered only in alternate years? Yes No

If yes, what will be the starting academic year? (i.e. 2014-15 or 2015-16) _____

11) General Education

Is this course being proposed for General Education? Yes No

Proposal forms are available at: <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>.

12) Course Computing Lab and Expendables Fees

DO NOT RECORD FEE INFORMATION HERE. Submit new course fee information on the New Course Fees Form available at: <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>.

13) Degree Programs which this course will affect

List the degrees, minors, and certificates in which this course will be required or used as an elective: ***

Degree Program(s): B.S. in Cybersecurity _____ _____ _____ _____ _____

*** Be sure to adjust the appropriate degree audits in sections 7 and 8 in your department's binder.

14) Course Rationale *(Required)*

This is a required core course for the proposed B.S. in Cybersecurity degree. Students need to understand risk assessment models, methodologies and processes, incident response and handling, related security policies and best practices.

15) Faculty Contact

Faculty proposing this course *(please print)*: Name **Yu Cai** _____

Email **cai@mtu.edu** _____

**DID YOU USE RED INK TO COMPLETE THIS FORM?
IF NOT, PLEASE HIGHLIGHT YOUR ANSWERS SO NOTHING IS MISSED IN PROCESSING.**



— Course Add Proposal — PLEASE COMPLETE THIS FORM IN RED

A guide for completing this form is located at <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>

1) Course Information

Is this a **half-semester course proposal**? Yes No

NOTE: All half-semester courses must follow rules set in Faculty Senate Proposal 4-00. See Senate website for details:
<http://www.sas.it.mtu.edu/usenate/propose/03/10-03.htm>

Course Prefix/Number (i.e. MEEM 2110): SAT4520

Course Title (abbreviated; used on transcript - Up to 30 characters including spaces)

Machine Learning in Security

Alternative Title for Catalog (Up to 100 characters including spaces)

Machine Learning in Cybersecurity

2) Credits

Number of credits assigned to this course ³ _____

OR

Range of credits if variable to (Number of credits to be taken in a given semester)

3) Schedule

Contact Hours per Week (Lec & Rec: 1 credit = 1 contact hour; Lab: 1 credit = 1-3 contact hours. (i.e. a 3-credit course may be 2 contact hours of lecture or recitation and up to 3 contact hours of lab OR 1 contact hour of lecture or recitation and up to 6 contact hours of lab))

Lecture

Recitation

Lab

OR

Research Course? Yes No

OR

Special Topics Course? Yes No

4) Additional Credits

May students receive **additional credits** by taking and passing this course more than once?

No

Yes, for a maximum of _____ credits. (Must be a multiple of the course credits, i.e. Research or Special Topics)

Yes, for an unlimited number of credits. (i.e. Music, Varsity sports, etc.)

5) Pass/Fail

Will this course be offered as a **pass/fail option ONLY?** (*grade of Sor E*) Yes No

6) Cross Listed/Equivalent Course

Cross Listed: Is there an identical course offered in a different subject or at a different level? Yes No

If yes, what is the other subject and course number? _____

Equivalent Course: Does this course replace a dropped course with no change in course content for degree requirements, prerequisites, and repeating purposes? Yes No

If yes, what is the subject and course number of the dropped course? _____

7) Corequisites and Prerequisites

Corequisites are courses that are **REQUIRED to be taken at the SAME TIME** as this course (courses **MUST** be offered during the same term):

Required corequisite course(s): _____ _____

Prerequisites are courses that are **REQUIRED to be taken PRIOR** to enrollment in this course. **Select appropriate box and use parentheses where needed.**

Required prerequisite course(s): 1_ SAT3812 <input checked="" type="checkbox"/> And <input type="checkbox"/> Or 2_ SAT4310 <input type="checkbox"/> And <input type="checkbox"/> Or 3_ _____ <input type="checkbox"/> And <input type="checkbox"/> Or 4_ _____ <input type="checkbox"/> And <input type="checkbox"/> Or 5_ _____ <input type="checkbox"/> And <input type="checkbox"/> Or 6_ _____
--

A **concurrent prerequisite** is a defined prerequisite course (from list above) that **MAY** be taken **EITHER** simultaneously in the same semester **OR** in a prior semester. Indicate below applicable courses.

Concurrent prerequisite course(s): _____ _____ _____

8) Catalog Course Description

The traditional catalog style description for a course is limited to **350 characters including spaces**. If course is proposed as a half-semester course, please include that information in the description. **Please refer to the Course Proposal Guide for examples and suggestions on developing a course description.**

Study of artificial intelligence and machine learning in cybersecurity. Topics include fundamentals of common machine learning and deep learning algorithms, intelligent threat detection and analysis, user behavior analytics, machine learning in hacking, and automated cybersecurity systems.

9) Registration Restrictions

- If permission is **always required** for registration purposes (a student cannot enter the course without department or instructor signature), please select the appropriate permission.

Do not select unless EVERY STUDENT must get "SIGNED INTO" the class.

Department **OR** Instructor

- Students who register for this course may be restricted by their **College/School OR** their **Major**. Please indicate if any college or major restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

No College/School Restrictions

No Major Restrictions

Colleges/Schools who MAY NOT enroll
(EXCLUDE)

-OR-

Colleges/Schools who MAY enroll (INCLUDE)

Majors that MAY NOT enroll
(EXCLUDE)

-OR-

Majors that MAY enroll (INCLUDE)

-- Restrictions continued on next page --

- A restriction may also be placed on **Class Standing** (freshman, sophomore, junior, senior, graduate). Please indicate if any class restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

No Class Restrictions

Class of students who MAY NOT enroll (EXCLUDE) _____ -OR- Class of students who MAY enroll (INCLUDE) _____

10) Semester(s) Offered

Fall Spring Summer *(Check all that apply)*

OR On Demand

If offered in a specific semester, will the course be offered only in alternate years? Yes No

If yes, what will be the starting academic year? (i.e. 2014-15 or 2015-16) _____

11) General Education

Is this course being proposed for General Education? Yes No

Proposal forms are available at: <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>.

12) Course Computing Lab and Expendables Fees

DO NOT RECORD FEE INFORMATION HERE. Submit new course fee information on the New Course Fees Form available at: <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>.

13) Degree Programs which this course will affect

List the degrees, minors, and certificates in which this course will be required or used as an elective: ***

Degree Program(s): B.S. in Cybersecurity _____ _____ _____ _____ _____

*** Be sure to adjust the appropriate degree audits in sections 7 and 8 in your department's binder.

14) Course Rationale *(Required)*

This is a required core course for the proposed B.S. in Cybersecurity (System and Network Concentration) degree. Students need to understand how to accomplish cybersecurity tasks with common machine learning and deep learning algorithms.

15) Faculty Contact

Faculty proposing this course *(please print)*: Name Yu Cai

Email cai@mtu.edu

**DID YOU USE RED INK TO COMPLETE THIS FORM?
IF NOT, PLEASE HIGHLIGHT YOUR ANSWERS SO NOTHING IS MISSED IN PROCESSING.**



— Course Add Proposal — PLEASE COMPLETE THIS FORM IN RED

A guide for completing this form is located at <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>

1) Course Information

Is this a **half-semester course proposal**? Yes No

NOTE: All half-semester courses must follow rules set in Faculty Senate Proposal 4-00. See Senate website for details:
<http://www.sas.it.mtu.edu/usenate/propose/03/10-03.htm>

Course Prefix/Number (i.e. MEEM 2110): CS4530

Course Title (abbreviated; used on transcript - Up to 30 characters including spaces)

Reverse Engr and Malware Anlys

Alternative Title for Catalog (Up to 100 characters including spaces)

Reverse Engineering & Malware Analysis

2) Credits

Number of credits assigned to this course ³ _____

OR

Range of credits if variable to (Number of credits to be taken in a given semester)

3) Schedule

Contact Hours per Week (Lec & Rec: 1 credit = 1 contact hour; Lab: 1 credit = 1-3 contact hours. (i.e. a 3-credit course may be 2 contact hours of lecture or recitation and up to 3 contact hours of lab OR 1 contact hour of lecture or recitation and up to 6 contact hours of lab)

Lecture

Recitation

Lab

OR

Research Course? Yes No

OR

Special Topics Course? Yes No

4) Additional Credits

May students receive **additional credits** by taking and passing this course more than once?

No

Yes, for a maximum of _____ credits. (Must be a multiple of the course credits, i.e. Research or Special Topics)

Yes, for an unlimited number of credits. (i.e. Music, Varsity sports, etc.)

5) Pass/Fail

Will this course be offered as a **pass/fail option ONLY?** (*grade of S or E*) Yes No

6) Cross Listed/Equivalent Course

Cross Listed: Is there an identical course offered in a different subject or at a different level? Yes No

If yes, what is the other subject and course number? SAT4530

Equivalent Course: Does this course replace a dropped course with no change in course content for degree requirements, prerequisites, and repeating purposes? Yes No

If yes, what is the subject and course number of the dropped course? _____

7) Corequisites and Prerequisites

Corequisites are courses that are **REQUIRED to be taken at the SAME TIME** as this course (courses **MUST** be offered during the same term):

Required corequisite course(s): _____ _____

Prerequisites are courses that are **REQUIRED to be taken PRIOR** to enrollment in this course. **Select appropriate box and use parentheses where needed.**

Required prerequisite course(s): 1_ <u>SAT3812</u> <input checked="" type="checkbox"/> And <input type="checkbox"/> Or 2_ <u>(CS3411</u> <input type="checkbox"/> And <input checked="" type="checkbox"/> Or 3_ <u>SAT4310)</u> <input type="checkbox"/> And <input type="checkbox"/> Or 4_ _____ <input type="checkbox"/> And <input type="checkbox"/> Or 5_ _____ <input type="checkbox"/> And <input type="checkbox"/> Or 6_ _____

A **concurrent prerequisite** is a defined prerequisite course (from list above) that **MAY** be taken **EITHER** simultaneously in the same semester **OR** in a prior semester. Indicate below applicable courses.

Concurrent prerequisite course(s): _____ _____ _____

8) Catalog Course Description

The traditional catalog style description for a course is limited to **350 characters including spaces**. If course is proposed as a half-semester course, please include that information in the description. **Please refer to the Course Proposal Guide for examples and suggestions on developing a course description.**

Study of software and hardware reverse engineering and malware analysis. Topics include principles of reverse engineering, reverse engineering tools and techniques, sandboxing, simulation methods and instrumentation, anti-reverse engineering techniques, static malware analysis, dynamic analysis, threat analysis, and automated analysis.

9) Registration Restrictions

- If permission is **always required** for registration purposes (a student cannot enter the course without department or instructor signature), please select the appropriate permission.

Do not select unless EVERY STUDENT must get "SIGNED INTO" the class.

Department **OR** Instructor

- Students who register for this course may be restricted by their **College/School OR** their **Major**. Please indicate if any college or major restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

No College/School Restrictions

No Major Restrictions

Colleges/Schools who MAY NOT enroll
(EXCLUDE)

-OR-

Colleges/Schools who MAY enroll (INCLUDE)

Majors that MAY NOT enroll
(EXCLUDE)

-OR-

Majors that MAY enroll (INCLUDE)

-- Restrictions continued on next page --

- A restriction may also be placed on **Class Standing** (freshman, sophomore, junior, senior, graduate). Please indicate if any class restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

No Class Restrictions

Class of students who MAY NOT enroll (EXCLUDE) _____
-OR-
Class of students who MAY enroll (INCLUDE) _____

10) Semester(s) Offered

Fall Spring Summer *(Check all that apply)*

OR On Demand

If offered in a specific semester, will the course be offered only in alternate years? Yes No

If yes, what will be the starting academic year? (i.e. 2014-15 or 2015-16) _____

11) General Education

Is this course being proposed for General Education? Yes No

Proposal forms are available at: <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>.

12) Course Computing Lab and Expendables Fees

DO NOT RECORD FEE INFORMATION HERE. Submit new course fee information on the New Course Fees Form available at: <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>.

13) Degree Programs which this course will affect

List the degrees, minors, and certificates in which this course will be required or used as an elective: ***

Degree Program(s): B.S. in Cybersecurity _____ _____ _____ _____ _____

*** Be sure to adjust the appropriate degree audits in sections 7 and 8 in your department's binder.

14) Course Rationale *(Required)*

This is a required core course for the proposed B.S. in Cybersecurity degree. Students need to understand software reverse engineering, hardware reverse engineering and malware analysis.

15) Faculty Contact

Faculty proposing this course *(please print)*: Name Yu Cai

Email cai@mtu.edu

**DID YOU USE RED INK TO COMPLETE THIS FORM?
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— Course Add Proposal — PLEASE COMPLETE THIS FORM IN RED

A guide for completing this form is located at <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>

1) Course Information

Is this a **half-semester course proposal**? Yes No

NOTE: All half-semester courses must follow rules set in Faculty Senate Proposal 4-00. See Senate website for details:
<http://www.sas.it.mtu.edu/usenate/propose/03/10-03.htm>

Course Prefix/Number (i.e. MEEM 2110): SAT4530

Course Title (abbreviated; used on transcript - Up to 30 characters including spaces)

Reverse Engr and Malware Anlys

Alternative Title for Catalog (Up to 100 characters including spaces)

Reverse Engineering & Malware Analysis

2) Credits

Number of credits assigned to this course ³ _____

OR

Range of credits if variable to (Number of credits to be taken in a given semester)

3) Schedule

Contact Hours per Week (Lec & Rec: 1 credit = 1 contact hour; Lab: 1 credit = 1-3 contact hours. (i.e. a 3-credit course may be 2 contact hours of lecture or recitation and up to 3 contact hours of lab OR 1 contact hour of lecture or recitation and up to 6 contact hours of lab))

3

Lecture

Recitation

Lab

OR

Research Course? Yes No

OR

Special Topics Course? Yes No

4) Additional Credits

May students receive **additional credits** by taking and passing this course more than once?

No

Yes, for a maximum of _____ credits. (Must be a multiple of the course credits, i.e. Research or Special Topics)

Yes, for an unlimited number of credits. (i.e. Music, Varsity sports, etc.)

5) Pass/Fail

Will this course be offered as a **pass/fail option ONLY?** (*grade of Sor E*) Yes No

6) Cross Listed/Equivalent Course

Cross Listed: Is there an identical course offered in a different subject or at a different level? Yes No

If yes, what is the other subject and course number? CS4530

Equivalent Course: Does this course replace a dropped course with no change in course content for degree requirements, prerequisites, and repeating purposes? Yes No

If yes, what is the subject and course number of the dropped course? _____

7) Corequisites and Prerequisites

Corequisites are courses that are **REQUIRED to be taken at the SAME TIME** as this course (courses **MUST** be offered during the same term):

Required corequisite course(s): _____ _____

Prerequisites are courses that are **REQUIRED to be taken PRIOR** to enrollment in this course. **Select appropriate box and use parentheses where needed.**

Required prerequisite course(s): 1_ <u>SAT3812</u> <input checked="" type="checkbox"/> And <input type="checkbox"/> Or 2_ <u>(CS3411</u> <input type="checkbox"/> And <input checked="" type="checkbox"/> Or 3_ <u>SAT4310)</u> <input type="checkbox"/> And <input type="checkbox"/> Or 4_ _____ <input type="checkbox"/> And <input type="checkbox"/> Or 5_ _____ <input type="checkbox"/> And <input type="checkbox"/> Or 6_ _____

A **concurrent prerequisite** is a defined prerequisite course (from list above) that **MAY** be taken **EITHER** simultaneously in the same semester **OR** in a prior semester. Indicate below applicable courses.

Concurrent prerequisite course(s): _____ _____ _____

8) Catalog Course Description

The traditional catalog style description for a course is limited to **350 characters including spaces**. If course is proposed as a half-semester course, please include that information in the description. **Please refer to the Course Proposal Guide for examples and suggestions on developing a course description.**

Study of software and hardware reverse engineering and malware analysis. Topics include principles of reverse engineering, reverse engineering tools and techniques, sandboxing, simulation methods and instrumentation, anti-reverse engineering techniques, static malware analysis, dynamic analysis, threat analysis, and automated analysis.

9) Registration Restrictions

- If permission is **always required** for registration purposes (a student cannot enter the course without department or instructor signature), please select the appropriate permission.

Do not select unless EVERY STUDENT must get "SIGNED INTO" the class.

Department **OR** Instructor

- Students who register for this course may be restricted by their **College/School OR** their **Major**. Please indicate if any college or major restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

No College/School Restrictions

No Major Restrictions

Colleges/Schools who MAY NOT enroll
(EXCLUDE)

-OR-

Colleges/Schools who MAY enroll (INCLUDE)

Majors that MAY NOT enroll
(EXCLUDE)

-OR-

Majors that MAY enroll (INCLUDE)

-- Restrictions continued on next page --

- A restriction may also be placed on **Class Standing** (freshman, sophomore, junior, senior, graduate). Please indicate if any class restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

No Class Restrictions

Class of students who MAY NOT enroll (EXCLUDE) <hr style="width: 50%; margin: 0 auto;"/> -OR- Class of students who MAY enroll (INCLUDE) <hr style="width: 50%; margin: 0 auto;"/>

10) Semester(s) Offered

Fall
 Spring
 Summer
 (Check all that apply)

OR On Demand

If offered in a specific semester, will the course be offered only in alternate years? Yes No

If yes, what will be the starting academic year? (i.e. 2014-15 or 2015-16) _____

11) General Education

Is this course being proposed for General Education? Yes No

Proposal forms are available at: <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>.

12) Course Computing Lab and Expendables Fees

DO NOT RECORD FEE INFORMATION HERE. Submit new course fee information on the New Course Fees Form available at: <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>.

13) Degree Programs which this course will affect

List the degrees, minors, and certificates in which this course will be required or used as an elective: ***

Degree Program(s): B.S. in Cybersecurity _____ _____ _____ _____ _____

*** Be sure to adjust the appropriate degree audits in sections 7 and 8 in your department's binder.

14) Course Rationale *(Required)*

This is a required core course for the proposed B.S. in Cybersecurity degree. Students need to understand software reverse engineering, hardware reverse engineering and malware analysis.

15) Faculty Contact

Faculty proposing this course *(please print)*: Name **Yu Cai** _____

Email **cai@mtu.edu** _____

**DID YOU USE RED INK TO COMPLETE THIS FORM?
IF NOT, PLEASE HIGHLIGHT YOUR ANSWERS SO NOTHING IS MISSED IN PROCESSING.**



— Course Add Proposal — PLEASE COMPLETE THIS FORM IN RED

A guide for completing this form is located at <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>

1) Course Information

Is this a **half-semester course proposal**? Yes No

NOTE: All half-semester courses must follow rules set in Faculty Senate Proposal 4-00. See Senate website for details:
<http://www.sas.it.mtu.edu/usenate/propose/03/10-03.htm>

Course Prefix/Number (i.e. MEEM 2110): CS4793

Course Title (abbreviated; used on transcript - Up to 30 characters including spaces)

Senior Design I

Alternative Title for Catalog (Up to 100 characters including spaces)

Senior Design I

2) Credits

Number of credits assigned to this course ² _____

OR

Range of credits if variable to (Number of credits to be taken in a given semester)

3) Schedule

Contact Hours per Week (Lec & Rec: 1 credit = 1 contact hour; Lab: 1 credit = 1-3 contact hours. (i.e. a 3-credit course may be 2 contact hours of lecture or recitation and up to 3 contact hours of lab OR 1 contact hour of lecture or recitation and up to 6 contact hours of lab)

Lecture

Recitation

6

Lab

OR

Research Course? Yes No

OR

Special Topics Course? Yes No

4) Additional Credits

May students receive **additional credits** by taking and passing this course more than once?

No

Yes, for a maximum of _____ credits. (Must be a multiple of the course credits, i.e. Research or Special Topics)

Yes, for an unlimited number of credits. (i.e. Music, Varsity sports, etc.)

5) Pass/Fail

Will this course be offered as a **pass/fail option ONLY?** (*grade of Sor E*) Yes No

6) Cross Listed/Equivalent Course

Cross Listed: Is there an identical course offered in a different subject or at a different level? Yes No

If yes, what is the other subject and course number? SAT4793

Equivalent Course: Does this course replace a dropped course with no change in course content for degree requirements, prerequisites, and repeating purposes? Yes No

If yes, what is the subject and course number of the dropped course? _____

7) Corequisites and Prerequisites

Corequisites are courses that are **REQUIRED to be taken at the SAME TIME** as this course (courses **MUST** be offered during the same term):

<p>Required corequisite course(s):</p> <p>_____</p> <p>_____</p>
--

Prerequisites are courses that are **REQUIRED to be taken PRIOR** to enrollment in this course. **Select appropriate box and use parentheses where needed.**

<p>Required prerequisite course(s):</p> <p>1_ <u>SAT3812</u></p> <p><input type="checkbox"/> And <input type="checkbox"/> Or 2 _____</p> <p><input type="checkbox"/> And <input type="checkbox"/> Or 3 _____</p> <p><input type="checkbox"/> And <input type="checkbox"/> Or 4 _____</p> <p><input type="checkbox"/> And <input type="checkbox"/> Or 5 _____</p> <p><input type="checkbox"/> And <input type="checkbox"/> Or 6 _____</p>
--

A **concurrent prerequisite** is a defined prerequisite course (from list above) that **MAY** be taken **EITHER** simultaneously in the same semester **OR** in a prior semester. Indicate below applicable courses.

<p>Concurrent prerequisite course(s):</p> <p>_____</p> <p>_____</p> <p>_____</p>
--

8) Catalog Course Description

The traditional catalog style description for a course is limited to **350 characters including spaces**. If course is proposed as a half-semester course, please include that information in the description. **Please refer to the Course Proposal Guide for examples and suggestions on developing a course description.**

Capstone course requiring the application of knowledge gained in lower division courses. Projects are team oriented, require weekly progress reports, and culminate with a final report and oral presentation.

9) Registration Restrictions

- If permission is **always required** for registration purposes (a student cannot enter the course without department or instructor signature), please select the appropriate permission.

Do not select unless EVERY STUDENT must get "SIGNED INTO" the class.

Department **OR** Instructor

- Students who register for this course may be restricted by their **College/School OR** their **Major**. Please indicate if any college or major restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

No College/School Restrictions

No Major Restrictions

Colleges/Schools who MAY NOT enroll
(EXCLUDE)

-OR-

Colleges/Schools who MAY enroll (INCLUDE)

Majors that MAY NOT enroll
(EXCLUDE)

-OR-

Majors that MAY enroll (INCLUDE)

B.S. in Cybersecurity

-- Restrictions continued on next page --

- A restriction may also be placed on **Class Standing** (freshman, sophomore, junior, senior, graduate). Please indicate if any class restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

No Class Restrictions

Class of students who MAY NOT enroll (EXCLUDE) <hr style="width: 50%; margin: 0 auto;"/> -OR- Class of students who MAY enroll (INCLUDE) Senior <hr style="width: 50%; margin: 0 auto;"/>
--

10) Semester(s) Offered

Fall Spring Summer *(Check all that apply)*

OR On Demand

If offered in a specific semester, will the course be offered only in alternate years? Yes No
 If yes, what will be the starting academic year? (i.e. 2014-15 or 2015-16) _____

11) General Education

Is this course being proposed for General Education? Yes No

Proposal forms are available at: <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>.

12) Course Computing Lab and Expendables Fees

DO NOT RECORD FEE INFORMATION HERE. Submit new course fee information on the New Course Fees Form available at: <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>.

13) Degree Programs which this course will affect

List the degrees, minors, and certificates in which this course will be required or used as an elective: ***

Degree Program(s): B.S. in Cybersecurity _____ _____ _____ _____ _____

*** Be sure to adjust the appropriate degree audits in sections 7 and 8 in your department's binder.

14) Course Rationale *(Required)*

This is the final capstone course I required for graduation for the proposed B.S. degree in Cybersecurity.

15) Faculty Contact

Faculty proposing this course *(please print)*: Name **Yu Cai** _____

Email **cai@mtu.edu** _____

**DID YOU USE RED INK TO COMPLETE THIS FORM?
IF NOT, PLEASE HIGHLIGHT YOUR ANSWERS SO NOTHING IS MISSED IN PROCESSING.**



— Course Add Proposal — PLEASE COMPLETE THIS FORM IN RED

A guide for completing this form is located at <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>

1) Course Information

Is this a **half-semester course proposal**? Yes No

NOTE: All half-semester courses must follow rules set in Faculty Senate Proposal 4-00. See Senate website for details:
<http://www.sas.it.mtu.edu/usenate/propose/03/10-03.htm>

Course Prefix/Number (i.e. MEEM 2110): SAT4793

Course Title (abbreviated; used on transcript - Up to 30 characters including spaces)

Senior Design I

Alternative Title for Catalog (Up to 100 characters including spaces)

Senior Design I

2) Credits

Number of credits assigned to this course ² _____

OR

Range of credits if variable to (Number of credits to be taken in a given semester)

3) Schedule

Contact Hours per Week (Lec & Rec: 1 credit = 1 contact hour; Lab: 1 credit = 1-3 contact hours. (i.e. a 3-credit course may be 2 contact hours of lecture or recitation and up to 3 contact hours of lab OR 1 contact hour of lecture or recitation and up to 6 contact hours of lab))

Lecture

Recitation

6

Lab

OR

Research Course? Yes No

OR

Special Topics Course? Yes No

4) Additional Credits

May students receive **additional credits** by taking and passing this course more than once?

No

Yes, for a maximum of _____ credits. (Must be a multiple of the course credits, i.e. Research or Special Topics)

Yes, for an unlimited number of credits. (i.e. Music, Varsity sports, etc.)

5) Pass/Fail

Will this course be offered as a **pass/fail option ONLY?** (*grade of Sor E*) Yes No

6) Cross Listed/Equivalent Course

Cross Listed: Is there an identical course offered in a different subject or at a different level? Yes No

If yes, what is the other subject and course number? CS4793

Equivalent Course: Does this course replace a dropped course with no change in course content for degree requirements, prerequisites, and repeating purposes? Yes No

If yes, what is the subject and course number of the dropped course? _____

7) Corequisites and Prerequisites

Corequisites are courses that are **REQUIRED to be taken at the SAME TIME** as this course (courses **MUST** be offered during the same term):

Required corequisite course(s): _____ _____

Prerequisites are courses that are **REQUIRED to be taken PRIOR** to enrollment in this course. **Select appropriate box and use parentheses where needed.**

Required prerequisite course(s): 1_ <u>SAT3812</u> <input type="checkbox"/> And <input type="checkbox"/> Or 2 _____ <input type="checkbox"/> And <input type="checkbox"/> Or 3 _____ <input type="checkbox"/> And <input type="checkbox"/> Or 4 _____ <input type="checkbox"/> And <input type="checkbox"/> Or 5 _____ <input type="checkbox"/> And <input type="checkbox"/> Or 6 _____

A **concurrent prerequisite** is a defined prerequisite course (from list above) that **MAY** be taken **EITHER** simultaneously in the same semester **OR** in a prior semester. Indicate below applicable courses.

Concurrent prerequisite course(s): _____ _____ _____

8) Catalog Course Description

The traditional catalog style description for a course is limited to **350 characters including spaces**. If course is proposed as a half-semester course, please include that information in the description. **Please refer to the Course Proposal Guide for examples and suggestions on developing a course description.**

Capstone course requiring the application of knowledge gained in lower division courses. Projects are team oriented, require weekly progress reports, and culminate with a final report and oral presentation.

9) Registration Restrictions

- If permission is **always required** for registration purposes (a student cannot enter the course without department or instructor signature), please select the appropriate permission.

Do not select unless EVERY STUDENT must get "SIGNED INTO" the class.

Department **OR** Instructor

- Students who register for this course may be restricted by their **College/School OR** their **Major**. Please indicate if any college or major restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

No College/School Restrictions

No Major Restrictions

Colleges/Schools who MAY NOT enroll
(EXCLUDE)

-OR-

Colleges/Schools who MAY enroll (INCLUDE)

Majors that MAY NOT enroll
(EXCLUDE)

-OR-

Majors that MAY enroll (INCLUDE)

B.S. in Cybersecurity

-- Restrictions continued on next page --

- A restriction may also be placed on **Class Standing** (freshman, sophomore, junior, senior, graduate). Please indicate if any class restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

No Class Restrictions

Class of students who MAY NOT enroll (EXCLUDE) <hr style="width: 50%; margin: 0 auto;"/> -OR- Class of students who MAY enroll (INCLUDE) Senior <hr style="width: 50%; margin: 0 auto;"/>
--

10) Semester(s) Offered

Fall Spring Summer *(Check all that apply)*

OR On Demand

If offered in a specific semester, will the course be offered only in alternate years? Yes No

If yes, what will be the starting academic year? *(i.e. 2014-15 or 2015-16)* _____

11) General Education

Is this course being proposed for General Education? Yes No

Proposal forms are available at: <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>.

12) Course Computing Lab and Expendables Fees

DO NOT RECORD FEE INFORMATION HERE. Submit new course fee information on the New Course Fees Form available at: <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>.

13) Degree Programs which this course will affect

List the degrees, minors, and certificates in which this course will be required or used as an elective: ***

Degree Program(s): B.S. in Cybersecurity _____ _____ _____ _____ _____

*** Be sure to adjust the appropriate degree audits in sections 7 and 8 in your department's binder.

14) Course Rationale *(Required)*

This is the final capstone course I required for graduation for the proposed B.S. degree in Cybersecurity.

15) Faculty Contact

Faculty proposing this course *(please print)*: Name **Yu Cai** _____

Email **cai@mtu.edu** _____

**DID YOU USE RED INK TO COMPLETE THIS FORM?
IF NOT, PLEASE HIGHLIGHT YOUR ANSWERS SO NOTHING IS MISSED IN PROCESSING.**



— Course Add Proposal — PLEASE COMPLETE THIS FORM IN RED

A guide for completing this form is located at <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>

1) Course Information

Is this a **half-semester course proposal**? Yes No

NOTE: All half-semester courses must follow rules set in Faculty Senate Proposal 4-00. See Senate website for details:
<http://www.sas.it.mtu.edu/usenate/propose/03/10-03.htm>

Course Prefix/Number (i.e. MEEM 2110): CS4794

Course Title (abbreviated; used on transcript - Up to 30 characters including spaces)

Senior Design II

Alternative Title for Catalog (Up to 100 characters including spaces)

Senior Design II

2) Credits

Number of credits assigned to this course ² _____

OR

Range of credits if variable to (Number of credits to be taken in a given semester)

3) Schedule

Contact Hours per Week (Lec & Rec: 1 credit = 1 contact hour; Lab: 1 credit = 1-3 contact hours. (i.e. a 3-credit course may be 2 contact hours of lecture or recitation and up to 3 contact hours of lab OR 1 contact hour of lecture or recitation and up to 6 contact hours of lab))

Lecture

Recitation

Lab

OR

Research Course? Yes No

OR

Special Topics Course? Yes No

4) Additional Credits

May students receive **additional credits** by taking and passing this course more than once?

No

Yes, for a maximum of _____ credits. (Must be a multiple of the course credits, i.e. Research or Special Topics)

Yes, for an unlimited number of credits. (i.e. Music, Varsity sports, etc.)

5) Pass/Fail

Will this course be offered as a **pass/fail option ONLY?** (*grade of Sor E*) Yes No

6) Cross Listed/Equivalent Course

Cross Listed: Is there an identical course offered in a different subject or at a different level? Yes No

If yes, what is the other subject and course number? SAT4794

Equivalent Course: Does this course replace a dropped course with no change in course content for degree requirements, prerequisites, and repeating purposes? Yes No

If yes, what is the subject and course number of the dropped course? _____

7) Corequisites and Prerequisites

Corequisites are courses that are **REQUIRED to be taken at the SAME TIME** as this course (courses **MUST** be offered during the same term):

Required corequisite course(s): _____ _____

Prerequisites are courses that are **REQUIRED to be taken PRIOR** to enrollment in this course. **Select appropriate box and use parentheses where needed.**

Required prerequisite course(s): 1_ <u>SAT4793</u> <input type="checkbox"/> And <input checked="" type="checkbox"/> Or 2_ <u>CS4793</u> <input type="checkbox"/> And <input type="checkbox"/> Or 3_ _____ <input type="checkbox"/> And <input type="checkbox"/> Or 4_ _____ <input type="checkbox"/> And <input type="checkbox"/> Or 5_ _____ <input type="checkbox"/> And <input type="checkbox"/> Or 6_ _____

A **concurrent prerequisite** is a defined prerequisite course (from list above) that **MAY** be taken **EITHER** simultaneously in the same semester **OR** in a prior semester. Indicate below applicable courses.

Concurrent prerequisite course(s): _____ _____ _____

8) Catalog Course Description

The traditional catalog style description for a course is limited to **350 characters including spaces**. If course is proposed as a half-semester course, please include that information in the description. **Please refer to the Course Proposal Guide for examples and suggestions on developing a course description.**

Capstone course requiring the application of knowledge gained in lower division courses. Projects are team oriented, require weekly progress reports, and culminate with a final report and oral presentation.

9) Registration Restrictions

- If permission is **always required** for registration purposes (a student cannot enter the course without department or instructor signature), please select the appropriate permission.

Do not select unless EVERY STUDENT must get "SIGNED INTO" the class.

Department **OR** Instructor

- Students who register for this course may be restricted by their **College/School OR** their **Major**. Please indicate if any college or major restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

No College/School Restrictions

No Major Restrictions

Colleges/Schools who MAY NOT enroll
(EXCLUDE)

-OR-

Colleges/Schools who MAY enroll (INCLUDE)

Majors that MAY NOT enroll
(EXCLUDE)

-OR-

Majors that MAY enroll (INCLUDE)

B.S. in Cybersecurity

-- Restrictions continued on next page --

- A restriction may also be placed on **Class Standing** (freshman, sophomore, junior, senior, graduate). Please indicate if any class restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

No Class Restrictions

Class of students who MAY NOT enroll (EXCLUDE) <hr style="width: 50%; margin: auto;"/> -OR- Class of students who MAY enroll (INCLUDE) Senior <hr style="width: 50%; margin: auto;"/>
--

10) Semester(s) Offered

Fall Spring Summer *(Check all that apply)*

OR On Demand

If offered in a specific semester, will the course be offered only in alternate years? Yes No

If yes, what will be the starting academic year? *(i.e. 2014-15 or 2015-16)* _____

11) General Education

Is this course being proposed for General Education? Yes No

Proposal forms are available at: <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>.

12) Course Computing Lab and Expendables Fees

DO NOT RECORD FEE INFORMATION HERE. Submit new course fee information on the New Course Fees Form available at: <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>.

13) Degree Programs which this course will affect

List the degrees, minors, and certificates in which this course will be required or used as an elective: ***

Degree Program(s): B.S. in Cybersecurity _____ _____ _____ _____ _____

*** Be sure to adjust the appropriate degree audits in sections 7 and 8 in your department's binder.

14) Course Rationale *(Required)*

<p>This is the final capstone course I required for graduation for the proposed B.S. degree in Cybersecurity.</p>
--

15) Faculty Contact

Faculty proposing this course *(please print)*: Name **Yu Cai** _____

Email **cai@mtu.edu** _____

**DID YOU USE RED INK TO COMPLETE THIS FORM?
IF NOT, PLEASE HIGHLIGHT YOUR ANSWERS SO NOTHING IS MISSED IN PROCESSING.**



— Course Add Proposal — PLEASE COMPLETE THIS FORM IN RED

A guide for completing this form is located at <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>

1) Course Information

Is this a **half-semester course proposal**? Yes No

NOTE: All half-semester courses must follow rules set in Faculty Senate Proposal 4-00. See Senate website for details:
<http://www.sas.it.mtu.edu/usenate/propose/03/10-03.htm>

Course Prefix/Number (i.e. MEEM 2110): SAT4794

Course Title (abbreviated; used on transcript - Up to 30 characters including spaces)

Senior Design II

Alternative Title for Catalog (Up to 100 characters including spaces)

Senior Design II

2) Credits

Number of credits assigned to this course ² _____

OR

Range of credits if variable to (Number of credits to be taken in a given semester)

3) Schedule

Contact Hours per Week (Lec & Rec: 1 credit = 1 contact hour; Lab: 1 credit = 1-3 contact hours. (i.e. a 3-credit course may be 2 contact hours of lecture or recitation and up to 3 contact hours of lab OR 1 contact hour of lecture or recitation and up to 6 contact hours of lab))

Lecture

Recitation

6

Lab

OR

Research Course? Yes No

OR

Special Topics Course? Yes No

4) Additional Credits

May students receive **additional credits** by taking and passing this course more than once?

No

Yes, for a maximum of _____ credits. (Must be a multiple of the course credits, i.e. Research or Special Topics)

Yes, for an unlimited number of credits. (i.e. Music, Varsity sports, etc.)

5) Pass/Fail

Will this course be offered as a **pass/fail option ONLY?** (*grade of Sor E*) Yes No

6) Cross Listed/Equivalent Course

Cross Listed: Is there an identical course offered in a different subject or at a different level? Yes No

If yes, what is the other subject and course number? CS4794

Equivalent Course: Does this course replace a dropped course with no change in course content for degree requirements, prerequisites, and repeating purposes? Yes No

If yes, what is the subject and course number of the dropped course? _____

7) Corequisites and Prerequisites

Corequisites are courses that are **REQUIRED to be taken at the SAME TIME** as this course (courses **MUST** be offered during the same term):

Required corequisite course(s): _____ _____

Prerequisites are courses that are **REQUIRED to be taken PRIOR** to enrollment in this course. **Select appropriate box and use parentheses where needed.**

Required prerequisite course(s): 1_ <u>SAT4793</u>
<input type="checkbox"/> And <input checked="" type="checkbox"/> Or 2_ <u>CS4793</u>
<input type="checkbox"/> And <input type="checkbox"/> Or 3_ _____
<input type="checkbox"/> And <input type="checkbox"/> Or 4_ _____
<input type="checkbox"/> And <input type="checkbox"/> Or 5_ _____
<input type="checkbox"/> And <input type="checkbox"/> Or 6_ _____

A **concurrent prerequisite** is a defined prerequisite course (from list above) that **MAY** be taken **EITHER** simultaneously in the same semester **OR** in a prior semester. Indicate below applicable courses.

Concurrent prerequisite course(s): _____ _____ _____

8) Catalog Course Description

The traditional catalog style description for a course is limited to **350 characters including spaces**. If course is proposed as a half-semester course, please include that information in the description. **Please refer to the Course Proposal Guide for examples and suggestions on developing a course description.**

Capstone course requiring the application of knowledge gained in lower division courses. Projects are team oriented, require weekly progress reports, and culminate with a final report and oral presentation.

9) Registration Restrictions

- If permission is **always required** for registration purposes (a student cannot enter the course without department or instructor signature), please select the appropriate permission.

Do not select unless EVERY STUDENT must get "SIGNED INTO" the class.

Department **OR** Instructor

- Students who register for this course may be restricted by their **College/School OR** their **Major**. Please indicate if any college or major restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

No College/School Restrictions

No Major Restrictions

Colleges/Schools who MAY NOT enroll
(EXCLUDE)

-OR-

Colleges/Schools who MAY enroll (INCLUDE)

Majors that MAY NOT enroll
(EXCLUDE)

-OR-

Majors that MAY enroll (INCLUDE)

B.S. in Cybersecurity

-- Restrictions continued on next page --

- A restriction may also be placed on **Class Standing** (freshman, sophomore, junior, senior, graduate). Please indicate if any class restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

No Class Restrictions

Class of students who MAY NOT enroll (EXCLUDE) _____ -OR- Class of students who MAY enroll (INCLUDE) Senior _____
--

10) Semester(s) Offered

Fall Spring Summer *(Check all that apply)*

OR On Demand

If offered in a specific semester, will the course be offered only in alternate years? Yes No

If yes, what will be the starting academic year? (i.e. 2014-15 or 2015-16) _____

11) General Education

Is this course being proposed for General Education? Yes No

Proposal forms are available at: <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>.

12) Course Computing Lab and Expendables Fees

DO NOT RECORD FEE INFORMATION HERE. Submit new course fee information on the New Course Fees Form available at: <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>.

13) Degree Programs which this course will affect

List the degrees, minors, and certificates in which this course will be required or used as an elective: ***

Degree Program(s): B.S. in Cybersecurity _____ _____ _____ _____ _____

*** Be sure to adjust the appropriate degree audits in sections 7 and 8 in your department's binder.

14) Course Rationale *(Required)*

<p>This is the final capstone course I required for graduation for the proposed B.S. degree in Cybersecurity.</p>
--

15) Faculty Contact

Faculty proposing this course *(please print)*: Name **Yu Cai** _____

Email **cai@mtu.edu** _____

**DID YOU USE RED INK TO COMPLETE THIS FORM?
IF NOT, PLEASE HIGHLIGHT YOUR ANSWERS SO NOTHING IS MISSED IN PROCESSING.**



— Course Add Proposal — PLEASE COMPLETE THIS FORM IN RED

A guide for completing this form is located at <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>

1) Course Information

Is this a **half-semester course proposal**? Yes No

NOTE: All half-semester courses must follow rules set in Faculty Senate Proposal 4-00. See Senate website for details:
<http://www.sas.it.mtu.edu/usenate/propose/03/10-03.htm>

Course Prefix/Number (i.e. MEEM 2110): CS4000

Course Title (abbreviated; used on transcript - Up to 30 characters including spaces)

Cybersecurity Policy and Law

Alternative Title for Catalog (Up to 100 characters including spaces)

National Cybersecurity Policy and Law

2) Credits

Number of credits assigned to this course ³ _____

OR

Range of credits if variable to (Number of credits to be taken in a given semester)

3) Schedule

Contact Hours per Week (Lec & Rec: 1 credit = 1 contact hour; Lab: 1 credit = 1-3 contact hours. (i.e. a 3-credit course may be 2 contact hours of lecture or recitation and up to 3 contact hours of lab OR 1 contact hour of lecture or recitation and up to 6 contact hours of lab))

Lecture

Recitation

Lab

OR

Research Course? Yes No

OR

Special Topics Course? Yes No

4) Additional Credits

May students receive **additional credits** by taking and passing this course more than once?

No

Yes, for a maximum of _____ credits. (Must be a multiple of the course credits, i.e. Research or Special Topics)

Yes, for an unlimited number of credits. (i.e. Music, Varsity sports, etc.)

5) Pass/Fail

Will this course be offered as a **pass/fail option ONLY?** (*grade of Sor E*) Yes No

6) Cross Listed/Equivalent Course

Cross Listed: Is there an identical course offered in a different subject or at a different level? Yes No

If yes, what is the other subject and course number? CS5000

Equivalent Course: Does this course replace a dropped course with no change in course content for degree requirements, prerequisites, and repeating purposes? Yes No

If yes, what is the subject and course number of the dropped course? _____

7) Corequisites and Prerequisites

Corequisites are courses that are **REQUIRED to be taken at the SAME TIME** as this course (courses **MUST** be offered during the same term):

Required corequisite course(s): _____ _____

Prerequisites are courses that are **REQUIRED to be taken PRIOR** to enrollment in this course. **Select appropriate box and use parentheses where needed.**

Required prerequisite course(s): 1_ <u>SAT3812</u> <input type="checkbox"/> And <input type="checkbox"/> Or 2 _____ <input type="checkbox"/> And <input type="checkbox"/> Or 3 _____ <input type="checkbox"/> And <input type="checkbox"/> Or 4 _____ <input type="checkbox"/> And <input type="checkbox"/> Or 5 _____ <input type="checkbox"/> And <input type="checkbox"/> Or 6 _____

A **concurrent prerequisite** is a defined prerequisite course (from list above) that **MAY** be taken **EITHER** simultaneously in the same semester **OR** in a prior semester. Indicate below applicable courses.

Concurrent prerequisite course(s): _____ _____ _____

8) Catalog Course Description

The traditional catalog style description for a course is limited to **350 characters including spaces**. If course is proposed as a half-semester course, please include that information in the description. **Please refer to the Course Proposal Guide for examples and suggestions on developing a course description.**

This course introduces the role of government in securing cyberspace. Students learn the basic national cybersecurity policy and law. Topics include federal, state, and local entities involved in cybersecurity, relevant laws and regulations, concepts of civil liberties, intellectual property, and privacy, and national security.

9) Registration Restrictions

- If permission is **always required** for registration purposes (a student cannot enter the course without department or instructor signature), please select the appropriate permission.

Do not select unless EVERY STUDENT must get "SIGNED INTO" the class.

Department **OR** Instructor

- Students who register for this course may be restricted by their **College/School OR** their **Major**. Please indicate if any college or major restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

No College/School Restrictions

No Major Restrictions

Colleges/Schools who MAY NOT enroll
(EXCLUDE)

-OR-

Colleges/Schools who MAY enroll (INCLUDE)

Majors that MAY NOT enroll
(EXCLUDE)

-OR-

Majors that MAY enroll (INCLUDE)

-- Restrictions continued on next page --

- A restriction may also be placed on **Class Standing** (freshman, sophomore, junior, senior, graduate). Please indicate if any class restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

No Class Restrictions

Class of students who MAY NOT enroll (EXCLUDE) _____ -OR- Class of students who MAY enroll (INCLUDE) _____

10) Semester(s) Offered

Fall Spring Summer *(Check all that apply)*

OR On Demand

If offered in a specific semester, will the course be offered only in alternate years? Yes No

If yes, what will be the starting academic year? (i.e. 2014-15 or 2015-16) _____

11) General Education

Is this course being proposed for General Education? Yes No

Proposal forms are available at: <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>.

12) Course Computing Lab and Expendables Fees

DO NOT RECORD FEE INFORMATION HERE. Submit new course fee information on the New Course Fees Form available at: <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>.

13) Degree Programs which this course will affect

List the degrees, minors, and certificates in which this course will be required or used as an elective: ***

Degree Program(s): B.S. in Cybersecurity _____ _____ _____ _____ _____

*** Be sure to adjust the appropriate degree audits in sections 7 and 8 in your department's binder.

14) Course Rationale *(Required)*

This is a required core course for the proposed B.S. in Cybersecurity degree. It is a dual listed course of CS5000. Students need to understand cybersecurity policy and law.

15) Faculty Contact

Faculty proposing this course *(please print)*: Name **Yu Cai** _____

Email **cai@mtu.edu** _____

**DID YOU USE RED INK TO COMPLETE THIS FORM?
IF NOT, PLEASE HIGHLIGHT YOUR ANSWERS SO NOTHING IS MISSED IN PROCESSING.**



— Course Add Proposal — PLEASE COMPLETE THIS FORM IN RED

A guide for completing this form is located at <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>

1) Course Information

Is this a **half-semester course proposal**? Yes No

NOTE: All half-semester courses must follow rules set in Faculty Senate Proposal 4-00. See Senate website for details:
<http://www.sas.it.mtu.edu/usenate/propose/03/10-03.htm>

Course Prefix/Number (i.e. MEEM 2110): SAT4817

Course Title (abbreviated; used on transcript - Up to 30 characters including spaces)

Sec Penetration Test and Audit

Alternative Title for Catalog (Up to 100 characters including spaces)

Security Penetration Testing and Audit

2) Credits

Number of credits assigned to this course ³ _____

OR

Range of credits if variable to (Number of credits to be taken in a given semester)

3) Schedule

Contact Hours per Week (Lec & Rec: 1 credit = 1 contact hour; Lab: 1 credit = 1-3 contact hours. (i.e. a 3-credit course may be 2 contact hours of lecture or recitation and up to 3 contact hours of lab OR 1 contact hour of lecture or recitation and up to 6 contact hours of lab))

Lecture

Recitation

Lab

OR

Research Course? Yes No

OR

Special Topics Course? Yes No

4) Additional Credits

May students receive **additional credits** by taking and passing this course more than once?

No

Yes, for a maximum of _____ credits. (Must be a multiple of the course credits, i.e. Research or Special Topics)

Yes, for an unlimited number of credits. (i.e. Music, Varsity sports, etc.)

5) Pass/Fail

Will this course be offered as a **pass/fail option ONLY?** (*grade of Sor E*) Yes No

6) Cross Listed/Equivalent Course

Cross Listed: Is there an identical course offered in a different subject or at a different level? Yes No

If yes, what is the other subject and course number? SAT5817

Equivalent Course: Does this course replace a dropped course with no change in course content for degree requirements, prerequisites, and repeating purposes? Yes No

If yes, what is the subject and course number of the dropped course? _____

7) Corequisites and Prerequisites

Corequisites are courses that are **REQUIRED to be taken at the SAME TIME** as this course (courses **MUST** be offered during the same term):

Required corequisite course(s): _____ _____

Prerequisites are courses that are **REQUIRED to be taken PRIOR** to enrollment in this course. **Select appropriate box and use parentheses where needed.**

Required prerequisite course(s): 1_ <u>SAT3812</u> <input type="checkbox"/> And <input type="checkbox"/> Or 2 _____ <input type="checkbox"/> And <input type="checkbox"/> Or 3 _____ <input type="checkbox"/> And <input type="checkbox"/> Or 4 _____ <input type="checkbox"/> And <input type="checkbox"/> Or 5 _____ <input type="checkbox"/> And <input type="checkbox"/> Or 6 _____

A **concurrent prerequisite** is a defined prerequisite course (from list above) that **MAY** be taken **EITHER** simultaneously in the same semester **OR** in a prior semester. Indicate below applicable courses.

Concurrent prerequisite course(s): _____ _____ _____

8) Catalog Course Description

The traditional catalog style description for a course is limited to **350 characters including spaces**. If course is proposed as a half-semester course, please include that information in the description. **Please refer to the Course Proposal Guide for examples and suggestions on developing a course description.**

To provide knowledge and demonstrated methods to help prevent security breaches and develop safeguards to protect sensitive information and confidential data. Primary focus will be on the healthcare sector. Students learn offensive and defensive security concepts, audit best-practices.

9) Registration Restrictions

- If permission is **always required** for registration purposes (a student cannot enter the course without department or instructor signature), please select the appropriate permission.

Do not select unless EVERY STUDENT must get "SIGNED INTO" the class.

Department **OR** Instructor

- Students who register for this course may be restricted by their **College/School OR** their **Major**. Please indicate if any college or major restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

No College/School Restrictions

No Major Restrictions

Colleges/Schools who MAY NOT enroll
(EXCLUDE)

-OR-

Colleges/Schools who MAY enroll (INCLUDE)

Majors that MAY NOT enroll
(EXCLUDE)

-OR-

Majors that MAY enroll (INCLUDE)

-- Restrictions continued on next page --

- A restriction may also be placed on **Class Standing** (freshman, sophomore, junior, senior, graduate). Please indicate if any class restrictions should be applied to this course. If there are no restrictions please indicate in the check box provided.

No Class Restrictions

Class of students who MAY NOT enroll (EXCLUDE) _____ -OR- Class of students who MAY enroll (INCLUDE) _____

10) Semester(s) Offered

Fall Spring Summer *(Check all that apply)*

OR On Demand

If offered in a specific semester, will the course be offered only in alternate years? Yes No

If yes, what will be the starting academic year? (i.e. 2014-15 or 2015-16) 2018-2019

11) General Education

Is this course being proposed for General Education? Yes No

Proposal forms are available at: <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>.

12) Course Computing Lab and Expendables Fees

DO NOT RECORD FEE INFORMATION HERE. Submit new course fee information on the New Course Fees Form available at: <http://www.mtu.edu/registrar/faculty-staff/course-proposal/>.

13) Degree Programs which this course will affect

List the degrees, minors, and certificates in which this course will be required or used as an elective: ***

Degree Program(s): B.S. in Cybersecurity _____ _____ _____ _____ _____

*** Be sure to adjust the appropriate degree audits in sections 7 and 8 in your department's binder.

14) Course Rationale *(Required)*

This is a required core course for the proposed B.S. in Cybersecurity degree (system and network concentration). It is a dual listed course of SAT5817. Students need to understand cybersecurity penetration testing and audit.

15) Faculty Contact

Faculty proposing this course *(please print)*: Name **Yu Cai** _____

Email **cai@mtu.edu** _____

**DID YOU USE RED INK TO COMPLETE THIS FORM?
IF NOT, PLEASE HIGHLIGHT YOUR ANSWERS SO NOTHING IS MISSED IN PROCESSING.**