New Program Proposal

Master of Science in Cybersecurity

Master of Science (M.S.) in Cybersecurity

Degree Requirements

Students must meet all general University of Missouri-St. Louis Graduate School admission and degree requirements.

Students must choose one of the following emphasis areas at the time of application for admission:

1. Information Systems Emphasis or
2. Computer Science Emphasis

Degree requirements vary depending on the chosen emphasis area.

Applicants must meet the general graduate admission requirements of the Graduate School, described in the UMSL catalog. Students are considered for admission to the graduate program in Cybersecurity only after they have formally applied for admission through the Graduate School.

Additional emphasis specific requirements are listed below.

M.S. Cybersecurity with Information Systems Emphasis

Admission Requirements

In addition to Graduate School admission requirements, the following requirements apply.

Applicants must have an undergraduate degree with a minimum cumulative GPA of 3.0. Students whose GPAs are between 2.75 and 2.9 may be admitted under a restricted status within the terms specified by the Graduate School.

Prior to entry, students must demonstrate competence in the following areas (through prior course work or professional experience) or take coursework at UMSL to fulfill the entry requirements.

- Business Statistics (similar to undergraduate course SCMA 3300). Students without a background in statistics could take SCMA 5300 as a graduate student to fulfill this requirement.
- At least one semester of computer programming coursework or application development work experience (similar to undergraduate courses INFSYS 3806 or INFSYS 3844). Students without programming background can take either INFSYS 6805 or INFSYS 6806 as a graduate student to fulfill this requirement.

Entrance examinations

- The Graduate Management Admission Test (GMAT) is not required for admission. However, it may be used by students when their overall GPA is below 3.0 to strengthen their application.
- International students are required to document English proficiency by providing scores from an internationally accepted standardized examination before a decision is made on admission

Coursework

Candidates for the M.S. in Cybersecurity with Information Systems Emphasis must complete 30 credit hours of graduate coursework subject to Graduate School requirements.

Required Courses		
INFSYS 6820	Systems and IT Infrastructure	3
INFSYS 6836	Management of Data Networks and Security	3
INFSYS 6828	Principles of Information Security	3
INFSYS 6858	Advanced Cybersecurity Concepts	3

INFSYS 6868	Software Assurance	3
INFSYS 6878	Management of Information Security	3
INFSYS 6847	Project Management	3
INFSYS 6888	Capstone in Information Security [1]	3
Electives (select two from following)		6
CMP SCI 5732	Cryptography for Computer Security	
CMP SCI 5750	Cloud Computing	
MGMT 5600	Managing People in Organizations	
INFSYS 5890	Graduate Internship in Information Systems	
INFSYS 5899	Individual Research in Information Systems[1]	
INFSYS 6818	Management of Software Testing	
INFSYS 6891	Seminar in Information Systems [1]	
INFSYS 6860	Data Integration	
Other electives upon approval of Information Systems department chair		
Total Hours		**30**

[1] Topic must be approved by Information Systems department chair

M.S. Cybersecurity with Computer Science Emphasis

Admission Requirements

Applicants must have at least a bachelor's degree, preferably in cybersecurity, computer science, information systems, or a related area.

Applicants with bachelor's degrees outside of specified areas must demonstrate significant proficiency by showing competence (proving related academic or professional experience, or taking a test) in the following areas. Courses in parenthesis are UMSL courses that can be used to fulfill the requirement.

1. Programming skills in C/C++ and Java with at least three college semesters or comparable experience (CMP SCI 1250; CMP SCI 2250 and CMP SCI 2261, or INFSYS 3806 and INFSYS 3816)
2. Proficiency with computer organization, architecture, or assembly level programming (CMP SCI 2700)
3. Familiarity with Unix/Linux/OSX and with command-line scripting with tools (CMP SCI 2750)

Students must also have satisfactorily completed mathematics courses equivalent to the following UMSL courses:

1. Survey Calculus or Calculus I (MATH 1100 or MATH 1800)
2. An elementary course in probability or statistics (MATH 1320)
3. A course in discrete mathematics (MATH 3000)

A student missing some of the above requirements may be admitted on restricted status if there is strong supportive evidence in other areas. The student will have to take the missing courses, or otherwise demonstrate proficiency. Special regulations of the Graduate School that apply to students on restricted status are described in the UMSL Bulletin.

Entrance examinations

- The Graduate Record Examination (GRE) General Test is required only to apply for an assistantship (see http://www.gre.org/ttindex.html).
- International students are required to document English proficiency by providing scores from an internationally accepted standardized examination before a decision is made on admission.

Coursework

Candidates for the M.S. in Cybersecurity with Computer Science emphasis must complete 30 credit-hours of graduate coursework, subject to the Graduate School regulations. Of these, at least 18 hours must be numbered 5000 or above. All courses numbered below 5000 must be completed with grades of at least B-. Outside computer science and information systems, up to 6 hours of related course work is allowed upon permission of the Graduate Director.

CMP SCI 4730	Computer Networks and Communications	3
CMP SCI 4760	Operating Systems	3
INFSYS 6828	Principles of Information Security	3
CMP SCI 5732	Cryptography for Computer Security	3
CMP SCI 5782	Advanced Information Security	3
CMP SCI 5888	Cybersecurity Capstone [1]	3
Electives (Choose four courses. At least two must be from Computer Science)		12
CMP SCI 4700	Computer Forensics	
CMP SCI 5750	Cloud Computing	
CMP SCI 5794	Security of IoT Systems	
INFSYS 6858	Advanced Cybersecurity Concepts	
INFSYS 6868	Software Assurance	
INFSYS 6878	Management of Information Security	
Other electives upon approval of Computer Science department chair		

Total Hours	**30**

[1] A student is allowed to work on three credit-hours of Master's Thesis (CMP SCI 6900) in place of Cybersecurity Capstone (CMP SCI 5888)

Sign-offs from other departments affected by this proposal

None

Rationale

Cybersecurity is currently one of the most critical issues facing individuals, organizations, governments, and society. Media reports are replete with breaches of information security and the adverse consequences for all stakeholders involved. At the same time, industry and government reports indicate a continued severe shortage of skilled cybersecurity talent across both public and private sectors.

Industry reports such as the *Frost & Sullivan* and *(ISC)* 2017 Global Information Security Workforce Study indicate a severe talent shortage. A projected 1.8 million cybersecurity positions will remain unfilled worldwide by year 2022, a 20% increase from a previous report targeting year 2020. 68% of North American respondents report that their security departments are understaffed and 52% attribute the cybersecurity talent shortage to an inability to find qualified candidates.

While many entry level positions in cybersecurity typically only require an undergraduate degree in cybersecurity or related fields, industry reports also indicate that many professionals coming from non-cybersecurity backgrounds such as IT and general Business are making a career switch into cybersecurity. In fact, due to the current shortage of talent in the field, it is common that people with undergraduate degrees in a diversity of majors are seeking training and education opportunities in cybersecurity to help them make the career-switch into cybersecurity. Further, the Global Knowledge, IT Skills and Salary Report 2018 indicates that a large majority of organizations are retraining existing staff to address the cybersecurity talent shortage. (please also see Workforce study report in footnote 3). Current enrollments in UMSL’s Graduate Certificate in Cybersecurity also suggest a similar pattern of students with existing undergraduate degrees seeking graduate level education in cybersecurity to enhance their career prospects. The proposed Master of Science in Cybersecurity degree addresses this broad need.

In addition, the M.S. Cybersecurity program proposed here has been designed to be multi-disciplinary and provides an opportunity for students to pursue either a technical focus (Computer Science Emphasis) or a management focus (Information Systems Emphasis). It complements the multi-disciplinary Bachelor of Science in Cybersecurity degree in two ways. First, it allows students with Computer Science or Information Systems emphasis in the undergraduate program to pursue the technical aspects of cybersecurity at a greater depth through the M.S. Cybersecurity Computer Science Emphasis or pursue the management aspects of cybersecurity through the M.S. Cybersecurity Information Systems Emphasis. Similarly, it allows students to switch emphasis areas when they pursue the graduate degree. Second, the 2+3 Dual Degree program makes the graduate degree attractive to undergraduate students by allowing them to finish both degrees within 5 years and saving them up to 15 credit hours.

The MS Cybersecurity program proposed here also differentiates itself from similar programs in the Saint Louis region. First, the MS programs are multi-disciplinary in nature as opposed to only Management focused or mostly technical focused programs. UMSL's programs will also likely undergo the NSA/DHS CAE-CDE designations further differentiating our programs.

In summary, the MS Cybersecurity program will serve both students from non-cybersecurity backgrounds making a transition into cybersecurity as well as students with existing cybersecurity backgrounds who wish to pursue greater depth or those who wish to diversify their skillsets. The programs provide good flexibility to students and are cost effective when compared with similar programs in the region.