

UNIVERSITY FACULTY SENATE FORMS

Academic Program Approval

This form is a routing document for the approval of new and revised academic programs. Proposing department should complete this form. Detailed instructions for the proposal should be followed. A [checklist](#) is available to assist in the preparation of a proposal. Submission of new majors or requests for permanent status will find additional requirements and information [here](#). For more information, call the Faculty Senate Office at 831-2921.

Submitted by: Stephan Bohacek _____ phone number 831-4274 _____

Department: Electrical and Computer Engineering _____ email address bohacek@udel.edu

Date: November 28, 2016 _____

Action: Establish 4+1 BCpE + MS-Cybersecurity

(Example: add major/minor/concentration, delete major/minor/concentration, revise major/minor/concentration, academic unit name change, request for permanent status, policy change, etc.)

Changes when approved will be effective at the start of the next academic year unless special circumstances and a specific request is made.

Current degree Separate BCpE and MS-Cybersecurity _____
(Example: BA, BACH, BACJ, HBA, EDD, MA, MBA, etc.)

Proposed change leads to the degree of: BCpE and MS-Cybersecurity _____
(Example: BA, BACH, BACJ, HBA, EDD, MA, MBA, etc.)

Proposed name: 4+1 in BCpE and MS-Cybersecurity _____
Proposed new name for revised or new major / minor / concentration / academic unit
(if applicable)

Revising or Deleting:

Undergraduate major / Concentration: _____
(Example: Applied Music – Instrumental degree BMAS)

Undergraduate minor: _____
(Example: African Studies, Business Administration, English, Leadership, etc.)

Graduate Program Policy statement change: _____
(Must attach your Graduate Program Policy Statement)

Graduate Program of Study: _____
(Example: Animal Science: MS Animal Science: PHD Economics: MA Economics: PHD)

Graduate minor / concentration: _____

Note: all graduate studies proposals must include an electronic copy of the Graduate Program Policy Document, either describing the new program or highlighting the changes made to the original policy document.

Below are the additions to the Electrical and Computer Engineering Graduate Programs section of the course catalog. Within the section titled REQUIREMENTS FOR THE DEGREES, the following will be added. No other changes are required.

4+1 Bachelor of Computer Engineering/Master of Science in Cybersecurity

The department offers a special 4 + 1 BCpE/Master of Science in Cybersecurity program for highly-qualified undergraduate students. The program allows the student to earn both the BCpE and the Master of Science in Cybersecurity degree in five years of full-time study in Electrical and Computer Engineering at the University of Delaware. Students must apply by April 1 of their junior year. GRE scores will be waived. For admissions to this program the following minimum criteria will be applied:

An undergraduate grade point average of 3.3 on a 4.0 scale.

A minimum of two letters of strong support from former teachers at the University of Delaware.

The application and processing instructions can be found at the Graduate Office website. Choose either an area or undecided and once you start the application, click on the 4 + 1 program option.

Students admitted to the 4 + 1 BCpE/Master of Science in Cybersecurity program are required to meet all the requirements listed for the Master of Science in Cybersecurity degree and can choose either the thesis or the non-thesis option (the thesis option can take more than five years to complete.) Students are required to complete two of the courses acceptable for the Master of Science in Cybersecurity degree during enrollment in the BCpE degree (600 level technical courses). These two courses can also be counted toward meeting the technical elective requirement of the BCpE degree.

ROUTING AND AUTHORIZATION: (Please do not remove supporting documentation.)

Department Chairperson  Date 12-5-16

Dean of College  Date 2/10/2017

(By signing above, the Dean confirms that their college policies and bylaws have been followed correctly during consideration of the request described in this form.

The approval actions that were taken at the college level were (check all that apply) :

college faculty vote; college curriculum approval college senate approval

Chairperson, College Curriculum Committee  Date 12/6/16

Chairperson, Senate Com. on UG or GR Studies _____ Date _____

Chairperson, Senate Coordinating Com. _____ Date _____

Secretary, Faculty Senate _____ Date _____

Date of Senate Resolution _____ Date to be Effective _____

Registrar _____ Program Code _____ Date _____

Vice Provost for Academic Affairs & International Programs _____ Date _____

Board of Trustee Notification _____ Date _____

Provide a brief summary of the proposed program changes and describe the rationale for the change(s):

(Explain your reasons for creating, revising, or deleting the curriculum or program.)

Currently, the Department of Electrical and Computer Engineering offers the Master of Science in Cybersecurity degree in two modalities, as a thesis and non-thesis master's degree. To expand our professional degree enrollment and in order to attract and retain highly qualified domestic applicants, we propose to establish a 4+1 BCpE/ Master of Science in Cybersecurity. The proposed program will give our highly-qualified and highly-motivated undergraduate students the opportunity to earn both the Bachelor's degree in computer engineering and the Master's degree in cybersecurity in five years of full-time study. Both, thesis and non-thesis options, will be offered in the 4+1 Master of Science in Cybersecurity, but the thesis option may take more than five years to complete.

List new courses required for the new or revised curriculum. How do they support the overall program objectives of the major/minor/concentrations)?

(Be aware that approval of the curriculum is dependent upon these courses successfully passing through the [Course Challenge](#) list. If there are no new courses enter "None")

None

Identify other units affected by the proposed changes and provide letters of support from those units. :

(This would include other departments/units whose courses are a required part of the proposed curriculum. If no other unit is affected, enter "None")

None

Changes to degree programs will explain how this new/revised curriculum supports the 5 goals of undergraduate education (do not just list the gen ed goals):

<http://www2.udel.edu/gened/>

New majors and minors will include support letters from the Library, Dean, and/or Department Chair

Supply a resolution for all new majors/programs; name changes of colleges, departments, degrees; transfer of departments from one college to another; creation of new departments; requests for permanent status. [See example of resolutions.](#)

Program Requirements:

(Show the complete new or revised curriculum as it should appear in the Course Catalog. If this is a revision, be sure to indicate the changes being made to the current curriculum and **include a complete side-by-side comparison** of the credit distribution before and after the proposed change. If this is a change to an honors program, be sure that the honors degree language is included.) [See example of side by side.](#)

the thesis-option requires 24 credit hours of coursework and six credits of master's thesis ([CPEG 869](#)). The curriculum requirements for the thesis and non-thesis option are:

- 15 credits of Fundamentals of Cybersecurity courses
- 15 credits of elective courses in a chosen Concentration Area.
 - Concentration Areas are: (I) Secure Software, (II) Secure Systems, (III) Security Analytics, and (IV) Security Management.
 - Elective courses are to be taken primarily from a single chosen Concentration Area, with a maximum of six (6) credits taken from an alternative Concentration Area or as additional Fundamentals of Cybersecurity courses.
 - In the thesis option, six (6) credits of master's thesis are to be completed in lieu of six (6) Concentration Area elective credits.

Fundamentals of Cybersecurity and Concentration Area courses are listed below. Note that individual courses are typically three (3) credits, i.e., the 30 credit hours required for the master's non-thesis degree typically equates to 10 courses (or eight (8) courses and a thesis for the thesis option).

Fundamentals of Cybersecurity

Students must complete 15 credits, or five (5) courses, of Fundamentals of Cybersecurity. Courses designated as Fundamentals of Cybersecurity are:

CPEG 665	Introduction to Cybersecurity (CYBER I)	3 cr
CPEG 697	Advanced Cybersecurity (CYBER II)	3 cr
CPEG 694	System Hardening & Protection (DEFENSE)	3 cr
CPEG 695	Digital Forensics	3 cr
CPEG 676	Secure Software Design	3 cr
CPEG 671	Pen Test and Reverse Engineering	3 cr
CPEG 672	Applied Cryptography	3 cr

Concentration Areas

Students must complete 15 credits, or five (5) courses, of electives. Elective courses are to be taken primarily from a single chosen Concentration Area. Of these five (5) elective courses, a maximum of two (2) can be taken outside the single Concentration Area (from one of the other Concentration Areas or from the set of Fundamentals of Cybersecurity courses). The Concentration Areas and courses within each area are listed below.

Concentration in Secure Software

The Secure Software Concentration is designed for a professional responsible for developing secure software systems. Secure Software electives are:

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<u>CPEG 670</u>	Web Applications Security	3 cr
<u>CISC 621</u>	Algorithm Design and Analysis	3 cr
<u>CISC 663</u>	Operating Systems	3 cr
<u>CISC 672</u> OR	Compiler Construction	3 cr
<u>CPEG 621</u>	Compiler Design	3 cr
<u>CISC 675</u>	Software Engineering Principles and Practices	3 cr
<u>CISC 611/CPEG 611</u>	Software Process Management	3 cr
<u>CISC 612/CPEG 612</u>	Software Design	3 cr
<u>CISC 613/CPEG 613</u>	Software Requirements Engineering	3 cr
<u>CISC 614/CPEG 614</u>	Formal Methods in Software Engineering	3 cr
<u>CISC 615/CPEG 615</u>	Software Testing and Maintenance	3 cr
<u>CPEG 676</u>	Secure Software Design	3 cr

Concentration in Secure Systems

The Secure Systems Concentration is designed for a professional responsible for secure systems that can include wireless and network communication systems, embedded systems, and related physical systems. Secure Systems electives are:

<u>ELEG 635</u>	Digital Communication	3 cr
<u>ELEG 658</u>	Advanced Mobile Services	3 cr
<u>ELEG 617</u>	The Smart Grid	3 cr
<u>CPEG 696</u>	Topics in Cybersecurity (Simulation-based Cybersecurity)	3 cr
<u>ELEG 812</u>	Wireless Digital Communications	3 cr
<u>CPEG 675</u>	Embedded Computer Systems	3 cr
<u>CISC 650/ELEG 651</u>	Computer Networks II	3 cr
<u>CISC 853</u>	Network Management	3 cr
<u>CPEG 673</u>	Cloud Computing and Security	3 cr
<u>CISC 886</u>	Multi-Agent Systems	3 cr
<u>CPEG 674</u>	SCADA Systems and Security	3 cr
<u>CPEG 853</u>	Computer System Reliability	3 cr

Concentration in Security Analytics

The Security Analytics Concentration is designed for a professional responsible for utilizing big data, analytics, and statistical learning methods to identify and characterize anomalous behavior and security risks. Security Analytics electives are:

<u>ELEG 815</u>	Analytics I – Statistical Learning	3 cr
<u>ELEG 817/FSAN 817</u>	Large Scale Machine Learning	3 cr
<u>CISC 683</u>	Introduction to Data Mining	3 cr
<u>CISC 637</u>	Database Systems	3 cr
<u>CPEG 657</u>	Search and Data Mining	3 cr
<u>CISC 681</u>	Artificial Intelligence	3 cr
<u>CISC 684</u>	Introduction to Machine Learning	3 cr
<u>CISC 689</u>	TPCS: Artificial Intelligence: Machine Learning	3 cr
<u>ELEG 630</u>	Information Theory	3 cr

Concentration in Security Management

The Security Management Concentration is designed for a professional responsible for instituting and managing security controls within an enterprise. Security Management electives are:

<u>MISY 850</u>	Security and Control	3 cr
<u>FINC 855</u>	Capital Markets & Financial Institutions	3 cr
<u>BUAD 840</u>	Ethical Issues in Domestic and Global Business Environments	3 cr
<u>MISY 840</u>	Project Management and Costing	3 cr
<u>ACCT 806</u>	Systems Analysis, Design and Implementation	3 cr
<u>BUAD 870</u>	Leadership and Organizational Behavior	3 cr
<u>BUAD 877</u>	Skills for Change Agents	3 cr
<u>MISY 810</u>	Telecommunications and Networking	3 cr