AN EDUCATIONAL PATHWAY IN CYBERSECURITY: 2-YEAR TO 4-YEAR COLLEGES

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Union County College, Cranford, NJ

American Honors Conference
Denver, CO - July 25, 2014
Search “cyber security” at Indeed.com reveals 5,000+ jobs

Top In-Demand Cybersecurity Jobs at Intel & IBM (Academic Initiatives)
- Data Security
- Application Security
- Network Security
- Security Analyst
- Cyber Operation Analyst
- Cybersecurity Forensic Analyst

Currently, almost all require baccalaureate preparation & credential
- Exception - Network Security

Federal government predicts 40,000 shortage of cyber professionals by 2020
Association for Computing Machinery (ACM)
- Committee for Computing Education in Community Colleges - www.capspace.org
- IT2008 & **CS2013** & Toward Curricular Guidelines in Cybersecurity (2013)
- MAT 267 Discrete Math – ACM Course Exemplar **CS2013**

ACM ITiCSE working group paper (2011)
- *Information Assurance Education in Two-Year and Four-Year Institutions*

Pilot project between public community college and private research university
- **Premise: community college students transfer with junior status**

NSF SFS Capacity Building Grant (2011-2014)
- Stevens Institute of Technology, Hoboken, NJ
- Union County College, Cranford, NJ
PILOT

2 community college students
- 1 graduated from UCC & transferred to Stevens May 2012
  - Graduated from Stevens May 2014 with a BS in cybersecurity
- 1 graduated from UCC & transferred to Stevens May 2013
  - Summer internship with the City of Hoboken, NJ
  - Expected graduation from Stevens May 2015 with a BS in cybersecurity

Summer bridge program ensured junior status
- 2 courses at Stevens – one in mathematics and one in computer science

Faculty mentoring and Peer tutoring
- UCC and Stevens
TRANSFER CURRICULUM

- Associate in Science (A.S.) degree in Mathematics - Cybersecurity Option
  - Passed curriculum committee and full faculty Spring 2014
  - VPAA approval Summer 2014

- 63 interdisciplinary credits
  - 17 credits: Mathematics
  - 15 credits: Computing
  - 31 credits: General Education
# Transfer Curriculum

## First Semester

<table>
<thead>
<tr>
<th>Course ID</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENG 101</td>
<td>English Comp. I</td>
<td>3</td>
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<tr>
<td>PHY 101</td>
<td>General Physics I</td>
<td>3</td>
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<tr>
<td>PHY L111</td>
<td>Mechanics Lab</td>
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<td><strong>MAT 171</strong></td>
<td><strong>Unified Calculus I</strong></td>
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<td><em>American Honors course</em></td>
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<td><strong>CSC 101</strong></td>
<td><strong>Computer Algorithms</strong></td>
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# Transfer Curriculum

## Second Semester

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<tr>
<td>PHY 102</td>
<td>General Physics II</td>
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<td>PHYL 102</td>
<td>General Physics II Lab</td>
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<tr>
<td>HIS 101</td>
<td>Intro. Western Civilization I</td>
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<tr>
<td><strong>MAT 172</strong></td>
<td><strong>Unified Calculus II</strong></td>
<td><strong>4</strong></td>
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<tr>
<td><strong>CSC 102</strong></td>
<td><strong>Data Structures</strong></td>
<td><strong>3</strong></td>
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<td><strong>&lt;Total&gt;</strong></td>
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<tr>
<td>Course ID</td>
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<td>Credits</td>
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<tr>
<td>-----------</td>
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</tr>
<tr>
<td>Elective</td>
<td>Humanities General Education (PHL 210 - Ethics recommended)</td>
<td>3</td>
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<tr>
<td>MAT 271</td>
<td>Unified Calculus III</td>
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<tr>
<td>MAT 265</td>
<td>Linear Algebra</td>
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<tr>
<td>CIS 210</td>
<td>Principles of Information Security</td>
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<tr>
<td>CSC 222</td>
<td>Organization, Operation, &amp; Assembly Language</td>
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<Total> 16
## Transfer Curriculum

### Fourth Semester

<table>
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<tr>
<th>Course ID</th>
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</thead>
<tbody>
<tr>
<td>Elective</td>
<td>Social Science General Education</td>
<td>3</td>
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<tr>
<td></td>
<td>(SOC, PSY or GOV recommended)</td>
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<tr>
<td>Elective</td>
<td>200 Level Mathematics Elective *</td>
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<tr>
<td>MAT 272</td>
<td>Differential Equations</td>
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<tr>
<td>MAT 267</td>
<td>Discrete Mathematics *</td>
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<td>&lt;ACM CS2013 course exemplar&gt;</td>
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<tr>
<td>CIS 202</td>
<td>Systems Analysis &amp; Design *</td>
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</tbody>
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* HORIZON *

- **Probability and Statistics course**
  - new course in development

- **Operating Systems course**
  - existing course - CSC 226
ARTICULATION AGREEMENTS

- **Stevens Institute of Technology, NJ**
  - Accepts all 63 credits in transfer
    - Junior status with bridge program before new AS degree
    - Junior status without bridge program after new AS degree

- **Pace University, NY**
  - Accepts all 63 credits in transfer – junior status without bridge program

- **Others anticipated**
  - CyberWatch – NSF ATE Center for Cybersecurity
    - NSA CAE/2Y
    - 2014 CISSE
WHY AMERICAN HONORS?

- Cutting Edge Program
- Natural Fit for AH Students
  - Academic Demands & Rigor
  - Curriculum & Pedagogy
- AH Calculus Course
REFERENCES

- Protecting Information: The Role of Community Colleges in Cybersecurity Education (AACC & NSF, 2002)
  www.capspace.org/committee/CommitteeFileUploads/RoleCCcybersecurityEducation.pdf
- Cybersecurity – (Inroads Community College Corner, 2003)
- An Exploration of the Current State of Information Assurance Education (ACM, 2009)
- Information Assurance Education in Two- and Four-Year Institutions (ACM, 2011)
  http://faculty.ucc.edu/compsci-hawthorne/sabbapp/InformationAssuranceEducationInTwoAndFourYearInstitutions2011.pdf
- IA Degree Programs with Course Descriptions for Sixteen Community Colleges and Two Universities (ancillary document, 2011) - http://faculty.ucc.edu/compsci-hawthorne/sabbapp/IAdegreeProgramsCommunityColleges2011.pdf
REFERENCES cont’d

- Software Assurance Curriculum Project Volume IV: Community College Education (CMU, 2011)
  http://resources.sei.cmu.edu/library/asset-view.cfm?assetid=10009
- Infusing Software Assurance in Computing Curricula (CMU, 2012)
  www.capspace.org/committee/CommitteeFileUploads/p18-hawthorneJune2012.pdf
- Multifarious Initiatives in Cybersecurity Education (ACM, 2013)
- Toward Curricular Guidelines in Cybersecurity (ACM, 2013)
  www.acm.org/education/TowardCurricularGuidelinesCybersec.pdf
- ACM/IEEE Computer Science Curricula 2013 (ACM, 2013)
  cs2013.org
Frost & Sullivan, industry research and analysis – www.frost.com

Rand Corporation, industry research and analysis - www.rand.org/pubs.html

Intel Cybersecurity Curriculum List –

IBM Academic Initiative –
www-304.ibm.com/ibm/university/academic/pub/page/academic_initiative
QUESTIONS & CONTACT

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- Cyndi Roemer – roemer@ucc.edu