University of Ontario
INSTITUTE OF TECHNOLOGY

Curriculum and Program Review Committee

Report to Academic Council

at its meeting of May 16, 2006

For Action

1. Faculty of Science Proposal to redesignate the BSc (Honours) in Energy and the Environment as a BSc (Honours) in Physics (Energy and the Environment Specialization)

The Curriculum and Program Review Committee recommends:

> That Academic Council approve the offering of a Bachelor of Science (Honours) in Physics (Energy and the Environment specialization) in place of the current Bachelor of Science (Honours) in Energy and the Environment (Physics specialization).

Rationale:

In 2004, the Bachelor of Science (Honours) in Energy and the Environment with specializations in Chemistry and Physics received Ministerial approval. Although the program is recognized for its innovation within the energy community, there have been insufficient enrolments to support the program in its existing format. One recruitment challenge has been the lack of a corresponding high school subject in this area. Most students who have applied to the Energy and the Environment Program are interested in the Physics specialization and, to date, these students have been offered alternative registration in the BSc in Physics program.

The Faculty of Science is proposing that the Energy and the Environment program be repackaged as a specialization under the Bachelor of Science degree in Physics. The program will be virtually identical to that which was previously approved, with only minor changes to strengthen the physics content of the specialization. Current and proposed program maps are included in Appendix A.

2. Faculty of Science: BSc in Physics (Forensic Physics Specialization)

The Curriculum and Program Review Committee recommends:

> That Academic Council approve a Forensic Physics specialization within the Bachelor of Science in Physics, as outlined in Appendix B.

Rationale:

The Faculty of Science currently offers undergraduate honours degrees in both Physics and Forensic Science; the Forensic Physics specialization will build on both of these programs. This specialization will draw on existing courses from the Forensic Science program and one new course in Physics. A business plan is included with this proposal.

Comments on the proposed specialization from the University Registrar can be found in Appendix E along with the response from the Dean of Science.

3. Faculty of Science: BSc in Computing Science (Specialization in Digital Media)

The Curriculum and Program Review Committee recommends:

> That Academic Council approve a Digital Media specialization within the Bachelor of Science in Computing Science, as outlined in Appendix C.

Rationale:

The Specialization in Digital Media builds on the current Bachelor of Science in Computing Science and extends it to cover the use of sound, images, graphics and video in interactive computer applications. Applications include computer games, educational software, mobile devices, marketing and advertising and location based services. Very few computer science programs concentrate on digital media and the introduction of this specialization will provide a market niche for UOIT.

This program will complement the existing Bachelor of Information Technology Game Development and Entrepreneurship Program in the Faculty of Business and Information Technology by covering the underlying technologies that are used in game development and other forms of digital media.

A business plan is included with the proposal.

Comments on the proposed specialization from the University Registrar can be found in Appendix E along with the response from the Dean of Science.

4. Faculty of Science: BSc in Computing Science (Specialization in Digital Forensics)

The Curriculum and Program Review Committee recommends:

> That Academic Council approve a Digital Forensics specialization within the current Bachelor of Science in Computing Science, as outlined in Appendix D.

Rationale:

As computers become more prevalent in our society, there is an increasing need for forensics experts to consider computers and related digital technology as important pieces of evidence. Due to the complexity of these technologies, specialized skills are required to analyze them in order to detect criminal activity and gather evidence. There is a growing need for educational programs to train specialists in this area.

The Faculty of Science currently offers undergraduate degrees in both Computing Science and Forensics. The Computing Science Specialization in Digital Forensics will build on both of these programs. This specialization will draw on existing courses in the Forensics program and two new courses in Computing Science. A business plan is included with the proposal.

Comments on the proposed specialization from the University Registrar can be found in Appendix E along with the response from the Dean of Science.

APPENDIX A

FACULTY OF SCIENCE
Bachelor of Science (Honours) in Physics
(Energy and the Environment Specialization)

Current and Proposed Program Maps:

TABLE 1: BSc (Honours) in Energy and the Environment - Physics Specialization (current program)

Year-Sem.	Subject	Subject	Subject	Subject	Subject
1-1	Calculus I	Chemistry I	Physics I	Biology I	Scientific Computing Tools
1-2	Calculus II	Chemistry II	Physics II	Biology II	Elective (Fundamentals of Programming recommended)
2-1	Linear Algebra	Electricity and Magnetism I	Mechanics I	Introductory Energy Science	Statistics and Probability for Physical Science
2-2	Introductory Environment Science	Differential Equations	Electricity and Magnetism II	Thermodynamics and Heat Transfer	Elective
3-1	Nuclear Physics and Relativity	Advanced Calculus I	Statistical Mechanics I	Quantum Mechanics I	Electronics
3-2	Mathematical Modelling	Waves and Optics	Fluid Mechanics	Elective	Elective
4-1	Solar Energy and Photovoltaics	Earth-Based Energy Systems	Directed Studies in Physics or Physics Thesis Project I	Elective	Elective
4-2	Hydrogen-Based Energy Systems and Fuel Cells	Economics and Politics of the Environment	Elective or Physics Thesis Project II	Elective	Elective

Courses to be interchanged

TABLE 2: New proposal for BSc (Honours) in Physics- Energy and the Environment specialization

Year-Sem.	Subject	Subject	Subject	Subject	Subject
1-1	Calculus I	Chemistry I	Physics I	Biology I	Scientific Computing Tools
1-2	Calculus II	Chemistry II	Physics II	Biology II	Elective (Fundamentals of Programming recommended)
2-1	Linear Algebra	Electricity and Magnetism I	Mechanics I	Nuclear Physics and Relativity	Statistics and Probability for Physical Science
2-2	Introductory Environment Science	Differential Equations	Electricity and Magnetism II	Thermodynamics and Heat Transfer	Elective
3-1	Introductory Energy Science	Advanced Calculus I	Statistical Mechanics I	Quantum Mechanics I	Electronics
3-2	Mathematical Modelling	Waves and Optics	Fluid Mechanics	Elective	Elective
4-1	Solar Energy and Photovoltaics	Earth-Based Energy Systems	Directed Studies in Physics or Physics Thesis Project I	Senior Physics Elective	Elective
4-2	Hydrogen-Based Energy Systems and Fuel Cells	Economics and Politics of the Environment	Senior Physics Elective or Physics Thesis Project II	Elective	Elective

Courses have been interchanged.

Two more physics courses are specified.

APPENDIX B

FACULTY OF SCIENCE
Proposal for BSc (Honours) in Physics (Forensic Physics specialization)

Introduction

A number of areas of Physics are of key importance to forensic analysis; among these are ballistics of bullets and other projectiles, the collisions of vehicles, the physics of explosions, and bloodstain patterns. Due to the complexity of these phenomena, specialized educational background and skills are required to analyze them. The general practice in the Forensic community is to hire Physics graduates who have a deep and broad background in Physics, and train them in the required elements of Forensics. There is a growing awareness of the need for educational programs to train specialists in this area, and this is the main reason for introducing this specialization within our Physics program. Internationally, there are very few undergraduate programs that address Forensic Physics; from a web search we have found two physics-based programs, along the lines of what we are proposing here, at the University of Sussex (which offers both a BSc and an MPhys) and at Nottingham Trent University, UK, and another in Canberra, Australia; we have found a program in the USA, at the University of Southern Mississippi which has a primary focus on Forensic Science with an emphasis (equivalent to our minor) in Physics, but this does not offer the deep physics knowledge that the Forensic community seeks. We have also found a number of individual courses on Forensic Physics. By being the first university in Canada to offer a Forensic Physics specialization based on a full BSc (Honours) Physics program we hope to establish UOIT as a leader in this field.

The Faculty of Science currently offers undergraduate honours degrees in both Physics and Forensic Science. The BSc (Honours) in Physics (Forensic Physics specialization) will build on both of these programs to produce a new stream within the Physics program that focuses on forensic physics. This will be basically a Physics degree with its electives drawn from the Forensic Science program and one new course in Physics. Except for the new Physics course, all the other courses in this new specialization are currently being offered in either the Physics or Forensic Science programs.

The Program

The specialization in forensic physics builds on the current program leading to the BSc (Honours) in Physics. It adds one new physics course, Forensic Physics, to the existing physics courses in the current honours physics program to provide specialized experience in applications of physics most likely to be encountered in forensic cases; it also adds five existing courses from the Forensic Science program that deal with general topics of interest for all branches of investigation – an Introduction to Forensic Science, Crime Scene Science, Criminalistics, Law, and Advanced Topics in Forensic Science. The new program map and a full course outline for the new course are found below in this document.

Year-Sem.	Subject	Subject	Subject	Subject	Subject
1-1	MATH 1010U Calculus I	CHEM1010U Chemistry I	PHY1010U Physics I	BIOL1010U Biology I	CSCI 1000U Scientific Computing Tools
1-2	MATH 1020U Calculus II	CHEM1020U Chemistry II	PHY1020U Physics II	BIOL1020U Biology II	FSCI 1010U Introductory Forensic Science
2-1	MATH 2050U Linear Algebra	PHY 2010U Electricity and Magnetism I	PHY 2030U Mechanics I	STAT 2010U Statistics and Probability for Physical Science	FSCI 2010U Crime Scene Science
2-2	MATH 2060U Differential Equations	PHY 2020U Electricity and Magnetism II	PHY 2040U Mechanics II	PHY 2050U Thermodynamics and Heat Transfer	Elective (CSCI 1020U Fundamentals of Programming recommended)
3-1	PHY 3010U Statistical Mechanics I	PHY 3020U Quantum Mechanics I	PHY 3030U Electronics	FSCI 3010U Criminalistics	Elective
3-2	PHY 3040U Mathematical Physics	PHY 3050U Waves and Optics	PHY 3060U Fluid Mechanics	Elective	Elective
4-1	PHY 4010U Statistical Mechanics II	PHY 4020U Quantum Mechanics II	PHY 4430U Directed Studies in Physics or PHY 4410U Physics Thesis Project I **	Elective	Elective
4-2	PHY 4030U Modern Physics	PHY 4120U Forensic Physics	Senior Physics Elective** or PHY 4420U Physics Thesis Project II **	FSCI 4050U Law for Forensic Scientists	FSCI 4060U Advanced Topics in Forensic Science

Courses added for the Forensic Physics specialization.

Course moved from original placement in Physics program

Note 1: Electives and Breadth Requirements Students must complete 21 elective credit hours including the senior physics elective. In order to satisfy breadth requirements, the remaining 18 elective credit hours may not be in physics (PHY) courses; at least 12 credit hours must be in courses outside the Faculty of Science and must include BUSI 2000U Collaborative Leadership.

Note 2: Directed Studies and Thesis Project Courses Students who have completed 90 credits of the program are eligible to take Directed Studies in Physics. This course may be offered in either semester, depending on demand. Students may optionally apply to do a two course sequence consisting of Thesis Project in Physics I and II in place of Directed Studies in Physics and a science elective. Opportunities for this option are limited; students must apply to the Science 4th year thesis coordinator by April 30 following completion of the first three years of the program.

Note 3: A senior physics elective is defined as any fourth-year physics course not explicitly specified in the program map.

BUSINESS PLAN

The Business Plan is based on the following assumptions:

- Annual intake will be 15 students; this should be reasonable to achieve because of general interest in Forensics and the absence of any competing program in Canada.
- Attrition factors are 0.8, 0.7, and 0.65 in years 2, 3, and 4, all relative to first year.
- Government grant is based on income per BIU = $5122 and formula fee = $2386.
- BIU weight for Science = 1 for year 1 and 2 for subsequent years.
- Government grant is discounted by 15% to pay for the building capital costs.
- One student = 1 FFTE.
- Tuition for Forensic Physics = $4184.
- No inflation factor is used.
- Average salary for FT faculty member is $90,000 plus 18.5% benefits; average stipend per course for PT faculty = $7500 plus 11% benefits.
- 20% of courses are taught by PT faculty.
- TA cost per hour = $30 for 14 weeks per semester (or equivalent $35 for 12 weeks)
- New lecture sections are required only for the new courses in this program.
- Existing Science courses are taken in existing sections; faculty costs are shared according to enrolment (e.g. if 25 students in FP are part of a lecture section of 150, then 25/150 of the cost of the faculty member is attributed to FP).
- All lab and tutorial costs are calculated on the same basis as for other Science programs. The hours for existing courses are specified in the Calendar, while hours for new courses are specified in the course descriptions.
- Electives and required courses from other Faculties are estimated at $11,000 per 50 students; costs include faculty and TA's.
- Other costs (such as operating costs for the Faculty of Science, lab supervisory costs, Faculty of Science administrative personnel costs etc) are calculated using the cost models that have been developed as a tool for income and expense calculations at UOIT.
- Intake levels in all other programs continue as projected by the Registrar's office for fall 2006.

Using the above assumptions, the following revenues and expenses are estimated as the Forensic Physics specialization rolls out (intake of 15 students each year):

	2007/08	2008/09	2009/10	2010/11
Revenue:	$97,644	$228,004	$347,500	$456,133
Expenditures:	$64,928	$139,835	$209,032	$302,372
Expenditures/Revenue:	66.5%	61.3%	60.2%	66.3%

However, the full effect of the introduction of this specialization as part of the Physics program cluster has to be viewed from the perspective of the resulting overall change in income and expense for the Physics cluster and the Faculty of Science as a whole, since the Forensic Physics program shares many costs with other programs, thereby reducing the expenses of those other programs, primarily within the Physics cluster, and also outside the cluster. The following table shows the increases in overall Science program revenue and expenditures resulting from introducing Forensic Physics (15 students):

	2007/08	2008/09	2009/10	2010/11
Increased Revenue:	$97,644	$228,004	$347,500	$456,133
Increased Expenditures:	$58,010	$83,861	$100,450	$127,365
Incr. Expenditures/Incr. Revenue:	59.4%	36.8%	28.9%	27.9%

Once the Forensic Physics specialization is fully rolled out with a steady state intake of 15 students, its effect will be to decrease the expense/income ratio for the Physics program cluster from 76.8% to 63.2%, and the overall Faculty of Science ratio from 54.9% to 53.4%.

APPENDIX C

FACULTY OF SCIENCE
Computing Science Specialization in Digital Media

Introduction

The Specialization in Digital Media builds on the current BSc in Computer Science, and extends it to cover the use of sound, images, graphics and video in interactive computer applications. The application areas covered by this specialization include computer games, educational software, mobile devices, marketing and advertising and location based services. Very few computer science programs concentrate on digital media, and the introduction of this specialization will strengthen our program.

The digital media industry is rapidly expanding and now forms an important part of the information technology industry. There is a growing need for people trained in this area, which is not being met by most of the existing computer science programs. This specialization is our response to the needs of this important industry sector. In addition, there is strong student demand for courses in this area, which will increase the Computing Science enrolment. Digital Media also tends to be more gender neutral than other forms of computer science, so it could assist with addressing the gender imbalance in computer science. There is a strong demand for the Game Development and Entrepreneurship specialization in the Bachelor of Information Technology program, which indicates that there will be a strong demand for this program as well.

This program is designed to complement the exiting Game Development and Entrepreneurship program in the Faculty of Business and Information Technology by covering the underlying technologies that are used in game development and other forms of digital media. As the two programs mature there is the possibility that students from the two programs could be involved in joint projects. Offering a wide range of programs and courses in this area will establish UOIT as a major player within the computer games and digital media arenas.

The Program

The specialization in digital media adds four courses to the current Computing Science program. These four courses are CSCI 2160U Digital Media, CSCI 4100U Mobile Devices, CSCI 4110U Advanced Computer Graphics and CSCI 4160U Interactive Media. These courses are required by the digital media specialization and are electives for other students in the Computing Science program. The program map and course descriptions are attached to this document.

Year-Sem.	Subject	Subject	Subject	Subject	Subject
1-1	Calculus I MATH 1010U	Physics I PHY 1010U	Chemistry I CHEM 1010U	Linear Algebra MATH 2050U	Scientific Computing Tools CSCI 1000U
1-2	Calculus II MATH 1020U	Physics II PHY 1020U	Chemistry II CHEM 1020U	Fundamentals of Programming CSCI 1020U	Biology for Engineers BIOL 1840U
2-1	Discrete Structures in Computer Science CSCI 2110U	Principles of Computer Science CSCI 2010U	Computer Architecture I CSCI 2050U	Statistics and Probability for Physical Science STAT 2010U	Elective
2-2	Computational Science I MATH 2070U	Software Systems Development and Integration CSCI 2020U	Elective	Elective	Digital Media CSCI 2160U
3-1	Analysis and Design of Algorithms CSCI 3070U	Operating Systems CSCI 3020U	Database Systems and Concepts CSCI 3030U	System Analysis and Design in Applications CSCI 3040U	Computer Networks CSCI 3150U
3-2	Computer Architecture II CSCI 3050U	Software Engineering CSCI 3060U	Compilers CSCI 4020U	Elective	Scientific Visualization and Computer Graphics CSCI 3090U
4-1	Simulation and Modelling CSCI 3010U	Computing Science Elective	Mobile Devices CSCI 4100U	Advanced Computer Graphics CSCI 4110U	Elective
4-2	Thesis Project CSCI 4400U	Ethics, Law and the Social Impact of Computing CSCI 4040U	Computing Science Elective	Interactive Media CSCI 4160U	Elective

New course in Computing Science program.

Electives and Breadth Requirements: Students are required to take 24 credit hours in electives, including 6 credit hours in computing science electives. In order to satisfy breadth requirements, the remaining 18 credit hours must be in courses outside computing science (CSCI); at least 12 credit hours must be in courses outside the Faculty of Science, and should include BUSI 2000U Collaborative Leadership.

Computing Science Electives

Artificial Intelligence	CSCI 4610U
Human-Computer Interaction	CSCI 4620U
High-Performance Computing	CSCI 4630U
Distributed Computing	CSCI 4640U
Elements of the Theory of Computation	CSCI 4650U
Computational Science II	MATH 4020U

BUSINESS PLAN

The Business Plan is based on the following assumptions:

- Annual intake will be 25 students; this should be reasonable to achieve because of general interest in Media and the scarcity of competing programs.
- Attrition factors are 0.8, 0.7, and 0.65 in years 2, 3, and 4, all relative to first year.
- Government grant is based on income per BIU = $5122 and formula fee = $2386.
- BIU weight for Science = 1 for year 1 and 2 for subsequent years.
- Government grant is discounted by 15% to pay for the building capital costs.
- One student = 1 FFTE.
- Tuition for Digital Media = $4184.
- No inflation factor is used.
- Average salary for FT faculty member is $90,000 plus 18.5% benefits; average stipend per course for PT faculty = $7500 plus 11% benefits.
- 20% of courses are taught by PT faculty.
- TA cost per hour = $30 for 14 weeks per semester (or equivalent $35 for 12 weeks)
- New lecture sections are required only for the new courses in this program.
- Existing Science courses are taken in existing sections; faculty costs are shared according to enrolment (e.g. if 25 students in DM are part of a lecture section of 150, then 25/150 of the cost of the faculty member is attributed to DM).
- All lab and tutorial costs are calculated on the same basis as for other Science programs. The hours for existing courses are specified in the Calendar, while hours for new courses are specified in the course descriptions.
- Electives and required courses from other Faculties are estimated at $11,000 per 50 students; costs include faculty and TA's.
- Other costs (such as operating costs for the Faculty of Science, lab supervisory costs, Faculty of Science administrative personnel costs etc) are calculated using the cost models that have been developed as a tool for income and expense calculations at UOIT.
- Intake levels in all other programs continue as projected by the Registrar's office for fall 2006.

Using the above assumptions, the following revenues and expenses are estimated as the Digital Media specialization rolls out (intake of 25 students each year):

	2007/08	2008/09	2009/10	2010/11
Revenue:	$162,740	$380,006	$575,545	$749,358
Expenditures:	$76,640	$183,874	$312,306	$452,683
Expenditures/Revenue:	47.1%	48.4%	54.3%	60.4%

However, the full effect of the introduction of this specialization as part of the Computing Science program cluster has to be viewed from the perspective of the resulting overall change in income and expense for the Computing Science cluster and the Faculty of Science as a whole, since the Digital Media program shares many costs with other programs, thereby reducing the expenses of those other programs, primarily within the Computing Science cluster, and also outside the cluster. The following table shows the increases in overall Science program revenue and expenditures resulting from introducing Digital Media (25 students):

	2007/08	2008/09	2009/10	2010/11
Increased Revenue:	$162,740	$380,006	$575,545	$749,358
Increased Expenditures:	$69,721	$135,308	$194,814	$294,864
Incr. Expenditures/Incr. Revenue:	42.8%	35.6%	33.8%	39.3%

Once the Digital Media specialization is fully rolled out with a steady state intake of 25 students, its effect will be to decrease the steady state expense/income ratio for the Computing program cluster from 72.5% to 55.0%, and the overall steady-state Faculty of Science ratio from 52.5% to 51.4%. These figures are computed assuming the Forensic Physics program and the course-sharing synergies agreed to with Software Engineering have been implemented.

Even more striking is the effect once both Digital Forensics at 15 students and Digital Media at 25 students are implemented. The effect will be to decrease the steady state expense/income ratio for the Computing program cluster from 72.5% to 51.1%, and the overall steady-state Faculty of Science ratio from 52.5% to 50.8%.

APPENDIX D

FACULTY OF SCIENCE
Computing Science Specialization in Digital Forensics

Introduction

The Faculty of Science currently offers undergraduate degrees in both Computing Science and Forensics. The Computing Science Specialization in Digital Forensics will build on both of these programs to produce a new stream within the Computing Science program that focuses on digital forensics. This will be basically a Computing Science degree with its electives drawn from the Forensics program and two additional courses in Computing Science. Except for the two new Computing Science courses, all the other courses in this program are currently being offered in either the Computing Science or Forensics programs.

As computers become more prevalent in our society there is an increasing need for forensics experts to consider computers and related digital technology as important pieces of evidence. Due to the complexity of these technologies specialized skills are required to analyze them in order to detect criminal activity and gather evidence. There is a growing awareness for the need for educational programs to train specialists in this area, and this is the main reason for introducing this specialization within our Computing Science program. Internationally, there are very few undergraduate programs that address digital forensics. Most of the existing programs are either graduate programs or certificate programs, and even these programs are relatively rare. By being one of the first universities to offer a Digital Forensics program we hope to establish UOIT as a leader in this field.

The Program

The program is very similar to the basic Computing Science program. The major difference is that CSCI 3040U Systems Analysis and Design in Applications and CSCI 3060U Software Engineering are replaced by CSCI 4120U Digital Evidence and CSCI 4130U Forensic Informatics. It was necessary to delete the two Computing Science courses in order to make room for the Forensics courses and still meet the Liberal Studies requirements. In addition, this program includes the following Forensics courses: FSCI 1010U Introduction to Forensic Science, FSCI 2010U Crime Scene Science, FSCI 3010U Criminalistics, FSCI 4050U Law for Forensic Science and FSCI 4060U Advanced Topics in Forensic Science. The course map for this new program and the course description for the two new Computing Science course are attached to this document.

Year-Sem.	Subject	Subject	Subject	Subject	Subject
1-1	Calculus I MATH 1010U	Physics I PHY 1010U	Chemistry I CHEM 1010U	Linear Algebra MATH 2050U	Scientific Computing Tools CSCI 1000U
1-2	Calculus II MATH 1020U	Introduction to Forensic Science FSCI 1010U	Chemistry II PHY 1020U	Fundamentals of Programming CSCI 1020U	Biology for Engineers BIOL 1840U
2-1	Discrete Structures in Computer Science CSCI 2010U	Principles of Computer Science CSCI 2010U	Computer Architecture I CSCI 2050U	Statistics and Probability for Physical Science STAT 2010U	Crime Scene Science FSCI 2010U
2-2	Computational Science I MATH 2072U	Software Systems Development and Integration CSCI 2020U	Physics II PHY 1020U	Elective	Elective
3-1	Analysis and Design of Algorithms CSCI 3070U	Operating Systems CSCI 3020U	Database Systems and Concepts CSCI 3030U	Computer Networks CSCI 3150U	Criminalistics FSCI 3010U
3-2	Computer Architecture II CSCI 3050U	Scientific Visualization and Computer Graphics CSCI 3090U	Compilers CSCI 4020U	Elective	Elective
4-1	Simulation and Modelling CSCI 3010U	Digital Evidence CSCI 4120U	Forensic Informatics CSCI 4130U	Computing Science Elective	Elective
4-2	Thesis Project CSCI 4400U	Ethics, Law and the Social Impact of Computing CSCI 4040U	Law for Forensic Science FSCI 4050U	Advanced Topics in Forensic Science FSCI 4060U	Elective

New course in Digital Forensics specialization.
Existing course in Forensic Science Program

Electives and Breadth Requirements: Students are required to take 21 credit hours in electives, including 3 credit hours in a computing science elective. In order to satisfy breadth requirements, the remaining 18 credit hours must be in courses outside computing science (CSCI); at least 12 credit hours must be in courses outside the Faculty of Science, and should include BUSI 2000U Collaborative Leadership.

BUSINESS PLAN

The Business Plan is based on the following assumptions:

- Annual intake will be 15 students; this should be reasonable to achieve because of general interest in Forensics and the scarcity of competing programs.
- Attrition factors are 0.8, 0.7, and 0.65 in years 2, 3, and 4, all relative to first year.
- Government grant is based on income per BIU = $5122 and formula fee = $2386.
- BIU weight for Science = 1 for year 1 and 2 for subsequent years.
- Government grant is discounted by 15% to pay for the building capital costs.
- One student = 1 FFTE.
- Tuition for Digital Forensics = $4184.
- No inflation factor is used.
- Average salary for FT faculty member is $90,000 plus 18.5% benefits; average stipend per course for PT faculty = $7500 plus 11% benefits.
- 20% of courses are taught by PT faculty.
- TA cost per hour = $30 for 14 weeks per semester (or equivalent $35 for 12 weeks)
- New lecture sections are required only for the new courses in this program.
- Existing Science courses are taken in existing sections; faculty costs are shared according to enrolment (e.g. if 25 students in DF are part of a lecture section of 150, then 25/150 of the cost of the faculty member is attributed to DF).
- All lab and tutorial costs are calculated on the same basis as for other Science programs. The hours for existing courses are specified in the Calendar, while hours for new courses are specified in the course descriptions.
- Electives and required courses from other Faculties are estimated at $11,000 per 50 students; costs include faculty and TA's.
- Other costs (such as operating costs for the Faculty of Science, lab supervisory costs, Faculty of Science administrative personnel costs etc) are calculated using the cost models that have been developed as a tool for income and expense calculations at UOIT.
- Intake levels in all other programs continue as projected by the Registrar's office for fall 2006.

Using the above assumptions, the following revenues and expenses are estimated as the Digital Forensics specialization rolls out (intake of 15 students each year):

	2007/08	2008/09	2009/10	2010/11
Revenue:	$97,644	$228,004	$347,500	$456,133
Expenditures:	$48,198	$108,922	$186,161	$283,046
Expenditures/Revenue:	49.4%	47.8%	53.6%	62.1%

However, the full effect of the introduction of this specialization as part of the Computing Science program cluster has to be viewed from the perspective of the resulting overall change in income and expense for the Computing Science cluster and the Faculty of Science as a whole, since the Digital Forensics program shares many costs with other programs, thereby reducing the expenses of those other programs, primarily within the Computing Science cluster, and also outside the cluster. The following table shows the increases in overall Science program revenue and expenditures resulting from introducing Digital Forensics (15 students):

	2007/08	2008/09	2009/10	2010/11
Increased Revenue:	$97,644	$228,004	$347,500	$456,133
Increased Expenditures:	$43,574	$72,949	$117,444	$185,586
Incr. Expenditures/Incr. Revenue:	44.6%	32.0%	33.8%	40.7%

Once the Digital Forensics specialization is fully rolled out with a steady state intake of 15 students, its effect will be to decrease the steady state expense/income ratio for the Computing program cluster from 72.5% to 59.6%, and the overall steady-state Faculty of Science ratio from 52.5% to 51.9%. These figures are computed assuming the Forensic Physics program and the course-sharing synergies agreed to with Software Engineering have been implemented.

Even more striking is the effect once both Digital Forensics at 15 students and Digital Media at 25 students are implemented. The effect will be to decrease the steady state expense/income ratio for the Computing program cluster from 72.5% to 51.1%, and the overall steady-state Faculty of Science ratio from 52.5% to 50.8%.

APPENDIX E

Comments from the University Registrar
Proposed Program Specializations

From: Richard Levin
Sent: Mon 4/24/2006 10:09
To: John Perz; Donald Wallace; Bill Muirhead
Cc: William Smith
Subject: RE: CPRC Meeting

John and Donald

Thanks for inviting my comments. I have a few thoughts:

Creating a broader and more innovative computing science program should ultimately make the program more attractive to applicants.

I continue to feel that greater specialization at the application stage is a risky strategy for recruitment; we have now seen a few highly specialized offerings fail as stand alone programs. The total pool of prospective students who are ready to select something as specialized as digital forensics at age 17 or 18 is relatively small. I would prefer it if students could declare these specializations as a major after year 1 or 2. If we did that, it would provide an opportunity to assess demand from existing students before committing to offering the programs, and avoid the further embarrassment of having to cancel programs.

I think both sets of projections are optimistic, especially taken as net new students. Note that applications to Forensic Science are down 10% this year. I think we would do very well to attract 5-10 students to Digital Forensics and maybe 15-25 for Digital media, especially in the first two years.

I worry about Digital Media creating competition for Gaming if offered at the application stage.

I hope this is a helpful, if not preferred, response.

Richard

Response from Dean of Science
Proposed Program Specializations

From: William Smith
Sent: Monday, April 24, 2006 11:43 AM
To: Richard Levin
Cc: John Perz; Donald Wallace; Bill Muirhead
Subject: RE: CPRC Meeting

Richard, thanks for your comments; they are always helpful.

We share your concerns about introducing greater specialization at the application stage. That's why we've moved Energy and the Environment into a physics specialization/stream, and the proposed Digital Media, Digital Forensics, and Forensic Physics are also specializations within core Science programs. These join the pattern of the existing specializations in our biological science, chemistry, and physics programs; all these specializations differ only very slightly from the core program "comprehensive" option.

The general purpose of the specializations is to attract students to the core disciplines and to provide program flexibility once they have entered (this flexibility is further enhanced by the fact that virtually all Science programs differ very little in first year. Thus, for example, students who might like the idea of the possibility of doing a forensic physics stream will be attracted to the physics program itself; the option of the stream is there. We always emphasize this fact to prospective students (the very small differences between a stream and the corresponding comprehensive program). I do agree that the pool of students who would select "digital forensics" at age 17 or 18 is small (but interestingly, we'd have the monopoly on the pool, at least for an initial period of time).

I believe that the general strategy of introducing marginally differing streams within our core programs is beginning to bear fruit ("basic science with a special flavour"), and that this is crucial to recruiting students to Science at UOIT (why would a student come here to study "vanilla" physics, biology, etc., when they could just as easily go to a more established university?) For example, I think that the increasing enrolments in both chemistry and physics are due at least in part to the development of the streams in pharmaceutical chemistry and medical physics. In biology, the addition of the Life Science stream has served a similar purpose. The other reason for the increasing enrolments in Science is the hard work that your staff and our Science faculty do in recruiting.

The one current exception to having a specialized degree from first year is Forensic Science. This is somewhat misleading, since even that program differs by only a single course in first year from all other Science programs. Again, our marketing of this program emphasizes the fact that it is a basic biology/chemistry program, that will serve a student well in these fields upon graduation (other FS programs do not share this characteristic.) As per your comment, I also noted from the most recent figures I have that the total application numbers for FS are down somewhat at this point compared with last year. However, I also noted that the "quality" of the applicants (number of first-choice applicants) is considerably higher than was the case last year (this is also true for Biological Science and for Concurrent Science/Education). Hopefully, this will result in a satisfactory yield for this well-subscribed program (and for the other programs).

On the point about competition of the Digital Media stream in Computing Science with the Gaming stream in B&IT: There should be minimal competition, since the Digital Media stream in CS is a stream within a highly technical (CS) program, quite unlike the Gaming stream. Also, the overall purpose of the Digital Media stream is very broad and quite different from the G stream. I attach a file containing an article from the US Chronicle of Higher Ed that suggests our proposed stream is in keeping with perceived educational trends in CS. A very significant point is that we expect the proposed stream to be very "female-friendly".

Finally, a point about predictions of the future. I think that one of the best guides to the future is the past. As cases in point, the recent specializations in pharmaceutical chemistry and medical physics were introduced for the first time this year. Based on your spreadsheet forecast of Feb. 6, 2006, we now expect (hope for?) in excess of 30 students in first-year chemistry and in excess of 20 in first-year physics (both totals exclude those taking the subjects as "first teachables" in Concurrent Education). These numbers are quite healthy for even a much larger institution. Of course, the numbers are still only "fuzzy predictions", and we will have to work hard to achieve (and hopefully exceed) them. I believe that the proposed CS and physics specializations will further enhance our student intakes in each program.

I look forward to working with your staff in promoting the new specializations.

Attachment
Article from the Chronicle of Higher Education – *Information Technology*
January 13, 2006 Issue

Wanted: Female Computer-Science Students

Colleges work to attract and support women in technology majors

By SCOTT CARLSON

Are computer programmers from Mars? Is computer science a guy thing? Some experts are wondering just that — at least, as it is taught now. While other fields, like mathematics, science, and chemistry, have seen growing enrollment and involvement of women, the number of women in computer science and related fields remains low and stagnant. According to the Computing Research Association, only 17 percent of undergraduate computer-science degrees were awarded to women in 2004, down from 19 percent in 2000. Those dwindling numbers come at a crucial time for the discipline, which has seen shrinking enrollments in since the dot-com bust.

Could it be that men are more attracted to the nuts and bolts of computers, while women are more interested in the social and cultural applications of the devices? Perhaps computer-science programs, suggest some researchers, are stacked against women and the way they learn.

Some women who have been successful in computer science, however, say that is nonsense. What is needed, they say, is more social support for women in the discipline — and for peers and parents to stop telling girls that computers are not for them.

To provide that support, programs and clubs for women in computer science have recently cropped up at colleges across the country, notably at Carnegie Mellon University and at the University of Maryland-Baltimore County.

Women who want to go into computer fields can face discouragement and discrimination from as early as grade school, through college, and into the work world. Consider the story of Kim, who graduated from Ohio University in 2004. Kim, who asked to remain anonymous, arrived at the university intending to major in mass communications. But, having grown up building ham radios with her father, she thought a technical field would provide better job options and offer more of a challenge.

Communications-systems management, a technical degree with lots of programming, was definitely challenging, but not in ways she had anticipated. She was one of only a handful of women in the program. "The guys wanted to be my partner when it came to writing papers, but no one wanted to be my partner when it came to lab time," she says.

Advising sessions for the degree were held at a local bar. "All the guys would sit together, eating the hot wings," she says. "I hated going there, because I knew that unless the other girls showed up, I would be sitting by myself."

The challenges did not end when she got her first job after graduation, at AT&T, as the only woman on a team of techies charged with selling equipment and services. On her first day, a senior male colleague tossed a pencil on the floor in front of her. "Could you pick that up?" he cooed, clearly wanting to ogle her.

"I was floored," she says. "I called home that night and just cried."

Downward Trend

Studies of women in technology inevitably refer to *Unlocking the Clubhouse: Women in Computing*, a highly influential and celebrated study of women in computer science, based on research conducted largely in the late 1990s at Carnegie Mellon. At the time of the study, only 7 percent of the computer-science majors at Carnegie Mellon were women.

Nationwide, "things have not changed that much," says Jane Margolis, a researcher at the Graduate School of Education and Information Studies at the University of California at Los Angeles, who was one of the book's authors. "In fact, they've gotten worse."

Her studies indicate that boys get more hands-on experience with computers at home. In addition, she says, games and computer software are generally designed by guys, for guys, and tend to engage boys more than girls.

In high-school and college courses, computer science is presented as straight programming, which is seen as tedious, especially by women, she says. Men are generally interested in computers as tools and objects of study, according to her research; women are more interested in what computers can do for science, the arts, or society.

"What our research found was that their motivation for learning computer science very much hung on the purpose that computing was going to be used for," she says. "It wasn't just hacking for hacking's sake. There was a real social context that gave them motivation and meaning."

In response to such findings, Carnegie Mellon changed the admissions policies for its School of Computer Science in 1999. Instead of primarily looking for students who had prior programming experience, the university broadened its criteria to include students who had ambitious goals, who showed leadership skills, and, of course, who had excellent grades. After 2000, the number of women entering the computer-science program went from below 10 percent to more than 30 percent and has held steady there since.

Lenore Blum, a professor of computer science, arrived at Carnegie Mellon just as the admissions policy changed and as the population of women in the program surged. Local newspapers were celebrating the arrival of women in the computer-science program. "I could see that unless we did something that provided the critical professional support for women in the program," Ms. Blum says, "you would see articles the following year saying that half the students had dropped out."

She wanted to set up a program that would foster the professional experiences and support for women at Carnegie Mellon that are "implicit and often not acknowledged for a majority in a population," she says.

The program, called Women@SCS, draws prominent female speakers from the world of technology who can serve as role models for the students. It runs a mentor service, in which women who are juniors and seniors can counsel freshmen and sophomores, offering support for course work or for dealing with the rigors of the major. Social occasions, like lunches, are set up to provide opportunities for the women to network.

"These are common-sense things to do, but you've got to do them," Ms. Blum says, adding that she is tired of hearing people bemoan the fact that computer science is losing female students. "What I'm realizing is that there is too much talk the talk and not enough walk the walk. We have the complete support of the president, the provost, the dean, and the chair of the department. They're not just saying, 'Hey, you're doing a good job.' They are paying the bill."

'Bias In, Bias Out'

The expanded population of women in Carnegie Mellon's computer-science program has given Ms. Blum the opportunity to do her own research on the classes of 2002 and 2004. She says her findings contradict some of the conclusions of *Unlocking the Clubhouse.* The book's research was tainted by "bias in, bias out," she argues, reflecting Carnegie Mellon's admissions requirements at the time, which rewarded programming experience that male students were more likely to possess.

Ms. Blum does not believe that women are oriented toward applications and that men are oriented toward programming. "We didn't see any gender differences at all, but found similar spectra in men and women," she says. "We found that there were some men who were hackers and some women who were hackers. ... One of the women we interviewed said that she kisses her computer every morning."

"To say that there are intrinsic male and female differences and you have to accommodate for those is absolutely wrong," she says. "Don't devise the curriculum so that it's female-friendly. That will only serve to marginalize women."

Other colleges have set up programs like Women@SCS. The University of Maryland-Baltimore County recently started the Center for Women and Information Technology, or CWIT, as it is more commonly known. The center supports female students in computer science, information science, computer engineering, and information studies. Women in the center's program live together on a designated floor of a residence hall, allowing for the sort of support that all-night programming sessions require. The center also helps women make connections with local companies for jobs and internships.

CWIT attempts to counter some of the negative influences that have ground down the students' self-esteem. Lindsay Mannchen, a senior, says she was one of two girls in her high-school programming courses, where her male peers told her again and again that she was no good at programming and that she was out of place.

"One of guys I grew up with and was in all of the classes with told me that, scientifically, girls were not programmed to do math like guys could," she says. "And I believed him."

Since joining the CWIT program in college, her attitude has changed, "mostly because I'm surrounded by girls who say, 'That's not right; don't listen to that,'" she says.

"I do notice that a lot of my classes are male-dominated, and in information science, we do a lot of group projects," she says. "The guys don't want to listen to the girls, unless you stand up and prove yourself right away."

The women's center is not all women. A select group of male students is involved with the program, a strategy to draw UMBC men into the conversation about women in technical fields. "It's not so much that only women can encourage us," says Amanda Schwenk, a freshman. "It's that the guys realize that it's harder for women to get a start or keep going in this, and that it's not exactly socially acceptable."

Social Factors

Claudia Morrell, executive director of CWIT, is not a computer scientist but a psychologist who has been studying the attitudes and influences of women and girls in computer science. Support programs for female computer-science majors can help women stay in the discipline, she argues, but crucial influences in childhood are strong factors in steering girls away from computer science and related fields.

"Parents are students' No. 1 source for decisions in career making," Ms. Morrell says. "Daughters tend to identify or align themselves with their mothers, and mothers aren't often the ones who are involved with technology." Meanwhile, dad is the one who is often fussing with the computer, hooking up the home stereo system, or even has a job involving technology.

When girls enter middle school, Ms. Morrell says, these perceptions begin to solidify into career goals, as young people start to form their identities. "At that age, gender issues become important as an expression of personal identity," she says. Too often, a middle-school girl who says she wants to be a computer scientist is treated much like a boy who says he wants to be a nurse — the professions carry gender identities, even if they are outdated.

Those gender identities still have power over enrollment choices. If schools offer computer-science or programming courses — and all too often they don't, scholars say — enrollment is often dominated by boys, who are already playing around with computers at home. A middle-school girl in a programming class might feel as out of place as a boy in a sewing course.

Add to all those influences the image of computer scientists and programmers well known in the media: the brilliant but socially inept mumbler who could use a few tips on hairstyles and clothes.

"Unfortunately, computer fields have a geeky image," Ms. Morrell says, "and girls in particular don't want to be perceived as geeks and nerds."

So by the time girls enter high school and start thinking about colleges and careers, computer science and related technology fields are distant thoughts compared with biology, chemistry, and mathematics, which have seen tremendous growth in women's participation in the past few decades.

Ms. Morrell and others at UMBC are trying to change that in Maryland with a couple of programs that are specifically aimed at middle-school girls. The university runs a summer program that invites girls to explore science and technology. While the girls are digging into computers, people from CWIT sit down with parents to talk about the troubles of attracting women to computer science, the subtle influences on that trend within the home, and the potential women have in the field.

The university also runs an after-school program at six suburban Baltimore middle schools, focusing on hands-on activities in science and technology. Supported by a $1-million grant from the National Science Foundation, the program covers basic tenets of science and technology, while giving students the opportunity to tear apart cameras to see how they work, to put together telephones from kits and string together a telephone network, and to create presentations on computers.

At a middle school in Essex, an economically depressed community east of Baltimore, Renee Yusuff and Anissa Nixon pore over a diagram for assembling a blue plastic telephone, barely looking up to answer a reporter's questions.

"I learned how to use a digital camera and how to use PowerPoint," Renee says when asked about her favorite lessons in the program. "I want to go into information technology." Anissa says that she is considering some kind of career in engineering.

True to Ms. Morrell's observations, the girls have had strong role models in technology within their families. Renee learned about computers from her uncle, who used to work on them in the basement at home. Anissa's mother used to climb telephone poles to repair lines for Verizon. "She was one of the only women in that job," Anissa says, then adds proudly, "and she was one of the best."

Mentors Needed

Among college women in computer science who were interviewed by The Chronicle, many recounted special circumstances from childhood that helped them enter the field and stick with it.

Amy Goodwin, a junior at Carnegie Mellon, picked up computers as early as elementary school because she had a learning disability that affected her handwriting. She dug into her laptop, a constant companion, and learned some common programming languages by sixth grade.

In programming classes in high school — at an all-girls school in Maryland, where, she says, girls "don't have to pretend not to be smart when they're around guys" — she says she knew far more than the students who enrolled from a nearby boys' school. Her mother, a law professor, was a strong figure in her life and taught her by example to persevere in a profession that is still an old-boys' club.

She considers her gender an asset — something that might make her stand out in job applications. Recruiters from Microsoft and from Google — who brought shirts with the o's in Google transformed into female symbols — came to Carnegie Mellon to talk about the opportunities for women in their companies. But she has also heard, from women who graduated from Carnegie Mellon a few years ago, stories about male colleagues who said things like "You don't belong here" and "You're only here because you're a woman."

"Those are the people that are out there in the work world," she says.

Ms. Blum and Ms. Morrell point out that their programs for women are building alumnae networks, through which women can find out about friendly workplaces and evangelize about the field. National organizations like the Anita Borg Institute for Women and Technology, which is composed of female professionals from the computer industry and academe, provide opportunities for women in the working world to get together and support one another.

Progress may come, if slowly. There was a time, Ms. Morrell points out, when number-crunching was the dominion of women. During World War II, many women were hired as "computers," solving long lists of equations for the war effort using mechanical desk calculators that were the precursors of mainframes. Grace Murray Hopper, an early programmer, is celebrated as a pioneer in the field, having found the first computer "bug." Ada Byron Lovelace, a 19th-century mathematician, is credited with writing the first computer program.

"We forget to celebrate," Ms. Morrell says, noting the progress that has been made over the years in mathematics and other sciences. "It's simply a matter of time before women see the professional opportunities and the financial opportunities. We'll reach a tipping point where women reach some level of comfort, and this will no longer be a problem."

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