

2-16-2004

Combined BS/MS in Computational Science

The College at Brockport, College Senate

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SUNY BROCKPORT

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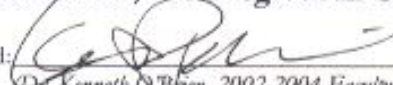
Resolution # 10 2003-2004 FACULTY SENATE

TO: Dr. Paul Yu, College President

FROM: The Faculty Senate Meeting on: **February 23, 2004**

RE: ↪ I. Formal Resolution (*Act of Determination*)
II. Recommendation (*Urging the Fitness of*)
III. Other, For Your Information (*Notice, Request, Report, etc.*)

SUBJ: **Combined BS/MS Program in Computational Science**

Signed:  Date: 2/25/04
(Dr. Kenneth A. Brennan, 2002-2004 Faculty Senate President)

TO: The Faculty Senate

FROM: Dr. Paul Yu, College President

RE: ↪ I. Decision and Action Taken on Formal Resolution (circle)

a. Accepted. Effective Date: 3/5/04

b. Deferred for discussion with the Faculty Senate on ___/___/___

c. Unacceptable for the reasons contained in the attached explanation

II, III. Response to Recommendation or Other/FYI

a. Received and acknowledged

b. Comment:

DISTRIBUTED TO: President's Staff
Deans Council originator, Registrar, Acad adv.

Distribution Date: 3-10-04

Signed:  Date: 3-5-04
(Dr. Paul Yu, President, SUNY College at Brockport)

**FACULTY SENATE OFFICE
RESOLUTION PROPOSAL COVER PAGE**

DEADLINE FOR SUBMISSIONS: MARCH 1 - *Proposals received after March 1 may not be reviewed until next semester.*

Submit all proposals to the Faculty Senate President electronically or on a disk with a hard copy.

Please provide cover page information requested.

facprez@brockport.edu, fSenate@brockport.edu

Faculty Senate Office, 426 Allen Building

NUMBER TO BE ASSIGNED BY SENATE OFFICE

ROUTING NUMBER*	8 03-04 BC/GC/UC
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1. PROPOSAL TITLE:

Please be somewhat descriptive, for example, *Graduate Probation/Dismissal Proposal* rather than *Graduate Proposal*.

Combined BS/MS program in Computational Science.

2. BRIEF DESCRIPTION OF PROPOSAL:

Proposal for a 5-year combined BS/MS program in Computational Science. The program is consistent with the latest revisions of undergraduate and graduate degree requirements for Computational Science, along with the latest General Education requirements. It has more stringent admission and retention requirements than the stand-alone BS and MS programs, includes no swing-level courses, and has a heavier research emphasis.

3. SUBMISSION & REVISION DATES: PLEASE DATE ALL UPDATED DOCUMENTS and resubmit to the Senate Office electronically prior to Senate review and vote at fSenate@brockport.edu.

First Submission	Updated on	Updated on	Updated on
<i>October 23, 2002</i>	October 9, 2003	January 20, 2004	

4. SUBMITTED BY: (contact person)

Name	Department	Phone	Email
Robert E. Tuzun	Computational Science	395-5368	rtuzun@brockport.edu

5. COMMITTEES TO COPY: (Senate office use only)

Committee	Forwarded To	Date
<input checked="" type="checkbox"/> Budget	Committee Chair Executive Committee Senate Floor College President	10/9/03, 1/22/04
<input type="checkbox"/> College Environment		12/1/03, 12/15/03, 1/26/04 mtg.
<input type="checkbox"/> Enrollment Policies		2/2/04
<input type="checkbox"/> General Education		2/27/04
<input checked="" type="checkbox"/> Graduate Curriculum		
<input type="checkbox"/> Personnel Policies		
<input type="checkbox"/> Student Policies		
<input checked="" type="checkbox"/> Undergraduate Curriculum		

*(ROUTING NUMBER WILL BE A CHRONOLOGICAL NUMBER SEQUENCE FOLLOWED BY YEAR & COMMITTEE INITIALS)

COMBINED BS/MS DEGREE PROGRAM IN COMPUTATIONAL SCIENCE

1. **Proposed Program Title:** Computational Science, BS/MS, HEGIS 0799
2. **Programs to be combined:**
 - a. Computational Science BS, PROG CODE: 20911
 - b. Computational Science MS, PROG CODE: 21502
3. **Existing and Proposed Programs** (Tables I and II)

Existing BS and MS Programs (76 credits in major)	Proposed Combined Program (65 credits in major)
<p>Bachelor's Degree (46 credits in major)</p> <p>Required Courses</p> <p style="text-align: center;">Computer Science (4 credits)</p> <p>CSC 203 Fund. of Computer Science I (4)</p> <p><u>Computational Science</u> (15 credits)</p> <p>CPS 201 Computational Tools I (3)</p> <p>CPS 202 Computational Tools II (3)</p> <p>CPS 303 Scientific Computing (3)</p> <p>CPS 304 Simulation and Modeling (3)</p> <p>CPS 404 Applied & Computational Mathematics (3)</p> <p style="text-align: center;">Mathematics (9 credits)</p> <p>MTH 203 Calculus III (3)</p> <p>MTH 243 Elementary Statistics (3)</p> <p>MTH 424 Linear Algebra (3)</p> <p>Electives – Science or Math (18 credits) 200-level and higher level courses in math or sciences</p> <p>Plus General Education and Other College Electives</p>	<p>Undergraduate requirements excluding those simultaneously applied to graduate degree (28 credits in major)</p> <p>Required Undergraduate Courses</p> <p style="text-align: center;">Computer Science (4 credits)</p> <p>CSC 203 Fund. of Computer Science I (4)</p> <p><u>Computational Science</u> (15 credits)</p> <p>CPS 201 Computational Tools I (3)</p> <p>CPS 202 Computational Tools II (3)</p> <p>CPS 303 Scientific Computing (3)</p> <p>CPS 304 Simulation and Modeling (3)</p> <p>CPS 404 Applied and Computational Mathematics (3)</p> <p style="text-align: center;">Mathematics (9 credits)</p> <p>MTH 203 Calculus III (3)</p> <p>[MTH 243 Elementary Statistics (3)]</p> <p>[OR]</p> <p>[MTH 346 Probability and Statistics (3)]</p> <p>MTH 424 Linear Algebra (3)</p> <p>Electives – Science or Math (6 credits) 200-level and higher level courses in math or sciences</p> <p>Plus General Education and Other College Electives</p>
<p>Master's Degree (30 credits)</p> <p style="text-align: center;">Required Courses (12 credits)</p> <p>CPS 533 Scientific Visualization (3)</p> <p>CPS 602 Advanced Software Tools (3)</p> <p>CPS 604 Computational Methods in the Physical Sciences (3)</p> <p>CPS 644 Supercomputing Applications (3)</p> <p>Required Research Experience (6 credits)</p> <p>CPS 699 Independent Study (3)</p> <p>CPS 710 Thesis (3)</p> <p>Elective Courses (12 credits)</p> <p>2 500-level or higher graduate courses (6)</p> <p>2 600-level or higher graduate courses (6)</p> <p><u>Computational Science</u></p> <p>CPS 504 Applied and Computational Math (3)</p> <p>CPS 511 Intro to Embedded Computing (3)</p> <p>CPS 521 Intro to Computational Physics (3)</p> <p>CPS 541 Intro to Computational Finance (3)</p> <p>CPS 555 Intro to Computational Fluid Dynamics (3)</p> <p>CPS 561 Intro to Computational Biology (3)</p> <p>CPS 632 Deterministic Dynamical Systems (3)</p> <p>CPS 633 Stochastic Dynamical Systems (3)</p> <p>NAS501 Computational Approaches to Math, Science, and Technology Education (3)</p>	<p>Duplicate requirements (12 credits applied simultaneously to undergraduate science and math electives and graduate required courses)</p> <p><u>Computational Science</u></p> <p>CPS 533 Scientific Visualization (3)</p> <p>CPS 602 Advanced Software Tools (3)</p> <p>CPS 604 Computational Methods in the Physical Sciences (3)</p> <p>CPS 644 Supercomputing and Applications (3)</p> <p>Graduate requirements excluding those simultaneously applied to undergraduate degree (19 credits)</p> <p>Required Research Experience (7 credits)</p> <p>CPS 698 Graduate Seminar (1)</p> <p>CPS 699 Independent Study (3)</p> <p>CPS 710 Thesis (3)</p> <p style="text-align: center;">Electives- Science or Math (12 credits)</p>

<p><u>Computer Science</u></p> <p>CSC 501 Theory of Programming Languages (3) CSC 506 Algorithms and Data Structures (3) CSC 511 Computer Architecture (3) CSC 512 Operating Systems (3) CSC 519 Computer Networks (3) CSC 521 Computer and Network Security (3) CSC 522 Relational Database Design (3) CSC 527 Software Engineering (3) CSC 529 Object-oriented Programming (3) CSC 534 Artificial Intelligence (3) CSC 542 Electronic Commerce Technology (3) CSC 544 Introduction to Parallel Computing (3) CSC 583 Theory of Computation (3)</p> <p><u>Mathematics</u></p> <p>MTH 521 Number Theory (3) MTH 541 Statistical Methods I (3) MTH 542 Statistical Methods II (3) MTH 546 Probability and Statistics II (3) MTH 551 Advanced Calculus (3) MTH 555 Differential Equations (3) MTH 557 Real Analysis (3) MTH 561 Math Models for Decision Making I (3) MTH 562 Math Models for Decision Making II (3) MTH 571 Numerical Analysis (3) MTH 581 Discrete Mathematics II (3) MTH 621 Algebra (3) MTH 628 Applications of Algebra (3) MTH 641 Mathematical Statistics (3) MTH 651 Real Analysis (3) MTH 659 Topics in Analysis (3) MTH 669 Topics in Applicable Mathematics and Statistics (3)</p>	<p>4 600-level or higher graduate courses (12)</p> <p><u>Computational Science</u></p> <p>CPS 632 Deterministic Dynamical Systems (3) CPS 633 Stochastic Dynamical Systems (3) CPS 699 Independent Study (up to 6 additional)</p> <p><u>Mathematics</u></p> <p>MTH 621 Algebra (3) MTH 628 Applications of Algebra (3) MTH 629 Topics in Algebra and Number Theory (3) MTH 641 Mathematical Statistics (3) MTH 651 Real Analysis (3) MTH 659 Topics in Analysis (3) MTH 669 Topics in Applicable Mathematics and Statistics (3)</p>
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Table II. Science/math courses in Faculty Senate approved and proposed combined programs.

<i>Senate-approved combined program</i> (56 credits in major)	<i>Proposed combined program</i> (65 credits in major)
<p>Required Courses</p> <p>Computational Science (21 credits) CPS 404 Applied & Computational Math (3) CPS 433 Scientific Visualization (3) PHS 302 Dynamical Systems (3) PHS 608 Advanced Instrument Interfacing I (1) PHS 609 Advanced Instrument Interfacing II (1) CPS 604 Computational Methods in the Physical Sciences (3) CPS 632 Deterministic Dynamical Systems (3) CPS 633 Stochastic Dynamical Systems (3)</p> <p><u>Computer Science</u> (11 credits) CSC 205 Fundamentals of Computer Science II (4) CSC 506 Algorithms and Data Structures (4) CSC 544 Parallel Computing (3)</p> <p>Mathematics (15 credits) MTH 203 Calculus III (3) MTH 424 Linear Algebra (3) MTH 542 Statistical Methods II (3) MTH 571 Numerical Analysis (3) MTH 581 Discrete Mathematics II (3)</p> <p>Undergraduate electives 2 upper-division courses (6)</p> <p><u>Research Experience</u> (4 credits) CPS 698 Graduate Seminar (1) CPS 700 Project Paper (3)</p>	<p>Required Courses</p> <p><u>Computational Science</u> (27 credits) CPS 201 Computational Tools I (3) CPS 202 Computational Tools II (3) CPS 303 Scientific Computing (3) CPS 304 Simulation and Modeling (3) CPS 404 Applied and Computational Mathematics (3) CPS 533 Scientific Visualization (3) CPS 602 Advanced Software Tools (3) CPS 604 Computational Methods in the Physical Sciences (3) CPS 644 Supercomputing and Applications (3)</p> <p>Computer Science (4 credits) CSC 203 Fundamentals of Computer Science I (4)</p> <p>Mathematics (9 credits) MTH 203 Calculus III (3) [MTH 243 Elementary Statistics (3)] [OR] [MTH 346 Probability and Statistics (3)] MTH 424 Linear Algebra (3)</p> <p>Undergraduate electives (6 credits) 2 upper-division courses</p> <p>Graduate Electives (12 credits) 4 600-level or higher graduate courses (12)</p> <p><u>Research Experience</u> (7 credits) CPS 698 Graduate Seminar (1) CPS 699 Independent Study (3) CPS 710 Thesis (3)</p>

Table III: A five-year sample schedule of the proposed combined BS/MS program in Computational Science.*

<u>FALL</u>	<u>SPRING</u>	
MTH 201 Calculus I (3)	MTH 202 Calculus II (3)	<i>Year I</i>
CPS 101 Intro to Computational Sci (3)	CSC 120 Intro to Computer Sci (3)	
General Education Elective (3)	General Education Elective (3)	
General Education Elective (3)	General Education Elective (3)	
General Education Elective (3)	General Education Elective (3)	
Total credits for the 1 st year (15+15) = 30		
Total credits at the end of the 1 st year = 30		
		<i>Year II</i>
MTH 243 Elementary Statistics (3)	MTH 203 Calculus III (3)	
CPS 201 Computational Tools I (3)	CPS 202 Computational Tools II (3)	
CSC 203 Fund. of Computer Science I (4)	CSC 205 Fund. of Computer Science II (4)	
General Education Elective (3)	General Education Elective (3)	
General Education Elective (3)	General Education Elective (3)	
Total credits for the 2 nd year (16+16) = 32		
Total credits at the end of the 2 nd year = 62		
		<i>Year III</i>
MTH 441 Statistical Methods I (3)	MTH 442 Statistical Methods II (3)	
MTH 455 Differential Equations (3)	MTH 424 Linear Algebra (3)	
CPS 303 Scientific Computing (3)	CPS 304 Simulation and Modeling (3)	
General Education Elective (3)	General Education Elective (3)	
General Education Elective (3)	Undergraduate Elective (3)	
Total credits for the 3 rd year (15+15) = 30		
Total credits at the end of the 3 rd year = 92		
Year IV		
CPS 404 Applied and Computational Math. (3)	CPS 533 Scientific Visualization (3)	
CPS 602 Advanced Software Tools (3)	CPS 698 Graduate Seminar (1)	
Grad elective at 600+ level (3)	Grad elective at 600+ level (3)	
Undergraduate Elective (3)	Undergraduate Elective (4)	
Undergraduate Elective (3)	Undergraduate Elective (3)	
Total credits for the 4 th year (15+14) = 29		
Total credits at the end of the 4 th year = 121**		
		<i>Year V</i>
CPS 604 Comput. Meth. Phys. Sci. (3)	CPS 710 Thesis (3)	
CPS 644 Supercomputing and Applications (3)	Grad elective at 600+ level (3)	
CPS 699 Independent Study (3)	Grad elective at 600+ level (3)	
Total credits for the 5 th year (9+9) = 18		
Total credits at the end of the 5 th year = 139		

*It should be noted that a 1996 Faculty Senate resolution does not allow students in combined programs to take graduate courses until 90 undergraduate credits have been completed. The sample combined program reflects this.

**The same Faculty Senate resolution allows up to 12 credits simultaneously applied to undergraduate and graduate requirements. In the fourth year of the sample combined program, there are 13 credits of graduate work, only 12 of which can count toward the undergraduate degree.

4. General Requirements (Table IV)

Credits Needed	BS	MS	BS+MS	BS/MS
Prerequisites	12		12	12
Required Courses	28	12	40	40

Elective Courses	18	12	30	18*
Research Experience		6	6	7
General Education	39**	0	39**	39**
Other College Electives	23		23	23
Total	120	30	150	139***
Normal Duration	4 years	2 years	6 years	5 years

*In the BS/MS program, CPS533 (Scientific Visualization), CPS602 (Advanced Computational Tools), CPS604 (Mathematical Methods in the Physical Sciences), and CPS644 (Supercomputing and Applications) are counted toward both the upper division undergraduate electives and graduate required courses. This reduces by 12 credits the total elective requirements relative to the separate BS+MS programs.

**The General Education requirement is 45 credits total. It is assumed that the major requirements will cover at least 6 of these.

***The combined BS/MS program contains 12 fewer elective credits than the separate BS and MS programs, but 1 more credit of research experience (CPS698—Seminar). This accounts for the 11 credit overall difference between the combined and separate programs.

5. Specific Requirements:

a. **Admission:** Before applying to the combined program, students must have met the college admissions criteria and been admitted to an undergraduate program at the college. Student may apply for admission to the combined degree after the successful completion of 54 credits, but no later than the accumulation of 84 credits. This program seeks to provide a fast track for capable students; therefore it is restricted to students with exceptional records. Students must have a 3.25 GPA overall and within the major to be able to enter the program. Entry into the program also requires an application that includes but is not limited to a one-page statement of interest, along with two letters of recommendation. The final decision of admission depends on an interview with the undergraduate and graduate directors. A student in good standing with fewer than 120 credits who withdraws from school will automatically be readmitted into the program if he or she returns within a year. Other returning students (those who were dropped from the program due to low performance) can re-apply to the program later as new applicants.

b. **Progression:** Students must have a 3.25 GPA overall and within the major to stay in the program. Students who fail to complete the combined program will have a fallback position, which is to complete the normal BS track. Students will then have the opportunity to apply any graduate credits earned toward the completion of their UNDERGRADUATE degree. The tuition rate is subject to college policies when students progress into taking graduate courses. Students will receive a BS at the completion of 120 credits (assuming all other undergraduate degree requirements are met) and MS at the end of the combined program. A student in good standing who has completed the BS degree requirements and who withdraws from school or reduces to part-time status will be bound by the 7-year limit to complete the MS segment of the degree program.

c. **Required Courses:** (including research experience)

Computer Science (4 credits)

CSC 203 Fund. of Computer Science (4)

How Often

Every Semester

Computational Science (34 credits)

CPS 201 Computational Tools I (3)

CPS 202 Computational Tools II (3)

CPS 303 Scientific Computing (3)

CPS 304 Simulation and Modeling (3)

CPS 404 Applied and Computational Math (3)

CPS 533 Scientific Visualization (3)

Every Fall

Every Spring

Every Fall

Every Spring

Every Fall

Every Spring

How Often

CPS 602 Advanced Software Tools (3)	Every Fall
CPS 604 Comput. Meth. Phys. Sci. (3)	Every Fall
CPS 644 Supercomputing and Applications (3)	Every Fall
CPS 698 Graduate Seminar (1)	Every Semester
CPS 699 Independent Study (3)	Every Semester
CPS 710 Thesis (3)	Every Semester

Mathematics (9 credits)

MTH 203 Calculus III (3)	Every Semester
[MTH 243 Elementary Statistics (3)	Every Semester]
[OR]
[MTH 346 Probability and Statistics I (3)	Every Semester]
MTH 424 Linear Algebra (3)	Every Semester

It should be noted that the combined program contains only one 500-level course (CPS533—Scientific Visualization), which is part of the core curriculum. As of the 2003-2004 academic year, CPS433 will no longer be offered, and CPS533 will function as a stand-alone graduate level course. Thus, there will be no swing courses in the combined BS/MS program.

d. Elective Courses:

Compared to the normal BS+MS track, the combined program has fewer elective course requirements. There are two reasons for this: 1) the combined BS/MS program has 12 fewer credits required than the normal BS+MS track, and 2) a student in the combined track has already made majority of his/her elective choices in the direction of the master's degree. Nevertheless, there is still plenty of opportunity for elective courses through the General Education program and other college requirements. Students in computational science are expected to gain knowledge and experience in areas of applications that use computers in real world. Students who complete 18 credits in an application field are recognized in their transcripts with a specialization in Computational-X where X is the complementary field of application to the core computational science. Common tracks are Computational {Biology, Chemistry, Finance, Mathematics, and Physics}.

In the combined program, only graduate electives at or above the 600 level are given credit. Available electives include:

Computational Science

CPS 632 Deterministic Dynamical Systems (3)
 CPS 633 Stochastic Dynamical Systems (3)
 CPS 699 Independent Study (up to 6 additional credits)

Mathematics

MTH 621 Algebra (3)
 MTH 628 Applications of Algebra (3)
 MTH 629 Topics in Algebra and Number Theory (3)
 MTH 641 Mathematical Statistics (3)
 MTH 651 Real Analysis (3)
 MTH 659 Topics in Analysis (3)
 MTH 669 Topics in Applicable Mathematics and Statistics (3)

e. Duration: Table III shows a sample five-year full-time course of study for completion of the combined program. The

first 3 years are spent with undergraduate courses, while the 4th year introduces students to graduate courses and the 5th year operates at the purely graduate level, including a culminating research experience. Students will have a fallback position, which is to complete a bachelor's degree with a minimum of 120 credits as required for a normal BS track.

- f. **Other Requirements:** As indicated in Tables I and II, the program requires 7 credits of research experience, including completion of a project in the form of an independent study (3 credits), a thesis/defense (3 credits), and a seminar (1 credit). The seminar requirement is not part of the stand-alone MS program; it is included in the combined program in order to help the students transition into computational research. There are no comprehensive examinations before completion of the degree. Each student must meet a residence requirement for the undergraduate as well as for the graduate program.
- g. **Quality:** The core courses for BS+MS and BS/MS are the same. Students who wish to take CSC and MTH (computer science and mathematics) courses can take them through electives. The focus on research experience also stays the same; both tracks require an independent study and a thesis/defense. However, the combined program also requires an additional 1-credit seminar. Students in the combined program must adhere to a higher standard of academic performance than the regular degree programs (GPA of 3.25 overall and in the major) in order to enter into and remain in the program. In addition, students in the combined program must take a more advanced level of coursework in that only 600-level or higher electives are counted toward the degree requirements.

The Computational Science department has a detailed assessment plan built on a set of core competencies (computational tools, programming languages and high performance computers, applied computational methods, simulation and modeling, visualization, oral and written communication, applications). Under each core competency, and sometimes spanning several core competencies, are a set of learning outcomes that provides (a) a rough curriculum map for the undergraduate and graduate programs, and (b) metrics for how well the students are learning the material. Other assessment takes place at the pre-admission and post-graduation stages (incoming GPA's, salary and employment history after graduation, number of students pursuing advanced degrees, and so on).

To track the relative performance of students in the stand-alone MS vs. combined programs, comparative statistics will be kept on student quality in the pre-admission and degree work phases, and on success after graduation (salary and employment, progression to doctoral level study, and so on). These comparative statistics will be used to help determine any needed areas for improvement.