December 15, 2015

MEMORANDUM

TO: Michael K. Young, President
FROM: Bob Strawser, Speaker
SUBJECT: Graduate Council (FS.33.128)

The Faculty Senate submits for your approval the item from the Graduate Council at its regular meeting on December 14, 2015. Attached is a copy of the material sent to our Senators.

Curriculum Change Request
Institute for Scientific Computation
Computational Sciences Certificate Program

FACULTY SENATE AGENDA ITEM REVIEW

This item has been reviewed by the Office of the Provost (OP). Below are recommended action(s):

- System Review/Submission
- BOR Approval
- THECB Approval/Notification
- SACSCOC Approval/Notification

Approved: __________ Reviewed: __________

Michael K. Young

Date: 2/1/16
Texas A&M University
Request for a Change in Curriculum
Undergraduate • Graduate • Professional

1. Program request type: [ ] Undergraduate [ ] Graduate [ ] First Professional (e.g., DVM, JD, MD, etc.)
   [ ] Degree Program [ ] Minor [ ] Certificate

2. Request change for:

3. Request submitted by (Department or Program Name):
   Institute for Scientific Computation (ISC)

4. Program Designation and Name
   (e.g., B.A. in History, Minor in History, Certificate in European Union):
   Computational Sciences Certificate Program

5. Brief description of change: The ISC proposes changing the Computational Sciences Certificate Program by introducing clarity into the catalog description, changing the curriculum from requiring two core and two elective courses to one core and three elective courses, and adding additional elective course options.

6. Rationale for change: Program changes will provide clarity in certificate requirements and facilitate increased student participation.

7. a. Proposed curriculum attached. [ ] Yes [ ] No
    b. Current catalog curriculum with handwritten edits attached. [ ] Yes [ ] No
    c. Current Howdy degree evaluation with handwritten edits attached. [ ] Yes [ ] No
       Please make sure the attached proposed curriculum, catalog and Howdy degree evaluation match.

8. a. Will degree program hours change (increase/decrease) due to the proposed curriculum changes? [ ] Yes [ ] No
    b. If yes, degree program hours will change from: ________ to: ________
    c. If yes, is the Texas Higher Education Coordinating Board form attached? [ ] Yes [ ] No
       [ ] http://www.thecb.state.tx.us/index.cfm?objectid=A0F9F7FA-9A92-4F11-2755AD3BBF01D60

9. If proposed changes affect other unit(s), are letters of support attached? [ ] Yes [ ] No

IMPORTANT NOTE: Curriculum changes submitted through the approval process and fully approved by February (December-UCGCC, January-Faculty Senate, February-President) will be effective in the next academic year. Changes requiring approval beyond the University should complete the internal approval process early in the fall semester whenever possible in order to ensure timely implementation.

Approval recommended by:

Yalcin Efendiev
Department/Head of Program Chair (Type Name & Sign) Date: 10/16/2015
Dean of College Date: 10-21-15

Chair, College Review Committee Date: 10-20-15
Chair, GC or UCC Date: 11-5-15

Questions regarding this form should be directed to Curricular Services at 845-8201 or sandra-williams@tamu.edu.
Curricular Services - 04/14
Proposed Catalog Description for the Computational Sciences Certificate Program:

The Institute for Scientific Computation developed the Computational Sciences Certificate Program to meet the increased need for computational techniques that help solve complex science and engineering problems. This program targets science and engineering students enrolled in graduate studies, providing them with a broad-based multidisciplinary enhancement to their degree program and preparing them with the intellectual infrastructure necessary as a leader in computational science, engineering, and technology. By completing this certification program, a graduate will receive an official certified transcript that will add value and marketability to their advanced degree. The Computational Sciences Certificate Program provides formal documentation on a student’s transcript that they successfully completed courses focused on computational aspects that supplement their degree in science or engineering. To fulfill the certification requirements, a student must complete four total courses (one core and three electives), as described by the program curriculum, and a capstone project within their home department. For more information, visit http://isc.tamu.edu.
### Proposed Curriculum for the Computational Sciences Certificate Program:

#### Core Courses
Select one of the following
- **MATH 609** Numerical Analysis
- **STAT 604** Topics in Statistical Computations
- **CSCE 659** Parallel/Distributed Numerical Algorithms and Applications
- **ECEN 659**

#### Elective Courses
Select three of the following, one of which must be exclusive of the student’s home department
- **AERO 615** Numerical Methods for Internal Flow
- **CSCE 603** Database Systems and Applications
- **CSCE 605** Compiler Design
- **CSCE 626** Parallel Algorithm Design and Analysis
- **CSCE 654** Supercomputing
- **CVEN 680** Advanced Computation Methods for Fluid Flow
- **CVEN 688** Computational Fluid Dynamics
- **GEOP 620** Geophysical Inverse Theory
- **MATH 610** Numerical Methods in Partial Differential Equations
- **MATH 648** Computational Algebraic Geometry
- **MATH 661** Mathematical Theory of Finite Element Methods
- **MATH 676** Finite Element Methods in Scientific Computing
- **MEEN 672** Introduction to Finite Element Method
- **NUEN 618** Multiphysics Computations in Nuclear Science and Engineering
- **OCNG 615** Numerical Modeling of Ocean Circulation I
- **PETE 656** Advanced Numerical Methods for Reservoir Simulation
- **STAT 605** Advanced Statistical Computations
- **STAT 608** Regression Analysis
- **STAT 626** Methods in Time Series Analysis
- **STAT 636** Applied Multivariate Analysis
- **CSCE 620** Computational Geometry
- **VIZA 670**
- **MATH 660** Computational Linear Algebra
- **CSCE 660**

#### Other
- **Capstone Project**

#### Total Semester Credit Hours
12

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1 MATH 609 will also satisfy the CSCE 653 prerequisite.
2 With approval by the director of the Institute for Scientific Computation (ISC), students may substitute a course outside those listed as elective options. In such situations, the student must justify the substitution to the ISC’s director prior to enrolling in the course. The director will include their support for the substitution in a memorandum to the Office of Graduate Studies (OGS) after the student files their degree plan with OGS and copies of these documents with the ISC.
3 The capstone project’s goal is to provide students with experience in the computational sciences. The capstone project may be fulfilled by:
   1. an independent study graduate course within the student’s home department, or
   2. an independent study graduate course outside the student’s home department, or
   3. as part of a MS thesis or project required by the student’s home department, or
   4. as part of a PhD dissertation.

To fulfill this requirement, the ISC’s associate director or director must approve the capstone project, certify its computational component, and document its completion.
Computational Sciences - Certificate

The Computational Sciences Certificate was developed to meet the increased need for computational techniques to help solve complex science and engineering problems. This program is targeted to science and engineering students enrolled in graduate studies. The goal of this certificate program is to provide formal documentation upon a student’s transcript that they have been exposed to courses focused on the computational aspects that supplement a given degree in science and engineering. To fulfill the certification requirements, a student must complete four courses, as described by the program outline, and a capstone project in their home department.

This certification will provide a graduate student with a broad-based multidisciplinary enhancement to his/her degree program or can serve as a precursor to a Ph.D. in computational science, mathematics, or technology. By joining this certification program, a graduate will receive an official transcript that will add value and marketability to her/his advanced degree. For more information, visit http://www.csce.tamu.edu/cegad or send an email message to csce@tamu.edu.

Program Requirements

Course Options
- Select two courses from two different departments, and exclusive of one’s home department.
- Select two courses from the given list, as long as they are not from the student’s home department.
- Capstone Project

Elective Courses

Core Courses
- MATH 609
- STAT 604
- CSCE/ECEN 659

Elective Courses
- Select three from the following, one of which must be exclusive of the student's home department:
  - MATH 610
  - MATH 660/CSCE 660
  - STAT 605
  - STAT 608
  - STAT 626
  - STAT 636
  - CSCE 603
  - CSCE 654
  - ECEN 660/MATH 660

Total Semester Credit Hours 12

Each of the following courses will be offered once every two years.

Each of the following courses will be offered once every two years.

MATH 609 will satisfy the CSCE 653 prerequisite.

Course Options

Mathematics

<table>
<thead>
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<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
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<td>MATH 609</td>
<td>Numerical Analysis</td>
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<tr>
<td>MATH 610</td>
<td>Numerical Methods in Partial Differential Equations</td>
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<tr>
<td>MATH 650</td>
<td>Computational Linear Algebra</td>
<td>3.0</td>
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<tr>
<td>CSCE 680</td>
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Statistics

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 604</td>
<td>Topics in Statistical Computations</td>
<td>3.0</td>
</tr>
<tr>
<td>STAT 605</td>
<td>Advanced Statistical Computations</td>
<td>3.0</td>
</tr>
<tr>
<td>STAT 608</td>
<td>Regression Analysis</td>
<td>3.0</td>
</tr>
</tbody>
</table>
DATE: October 12, 2015

TO: Dr. Bradley Shumbera
   Assistant Director, Institute for Scientific Computation

FROM: Rodney Bowersox
       Professor and Head of Aerospace Engineering

SUBJECT: Computational Sciences Certificate Program

I support the Institute for Scientific Computation's efforts to revitalize the Computational Sciences Certificate Program by including AERO 615, Numerical Methods for Internal Flow, from the Department of Aerospace Engineering in its curriculum.
MEMORANDUM:

TO: R. Bradley Shumbera  
   Assistant Director, Institute for Scientific Computation

FROM: Dilma Da Silva  
   Department Head, Professor and Holder of the Ford Motor Company Design Professorship II

DATE: October 9, 2015

SUBJECT: Computational Science Certificate Program Changes

I support the Institute for Scientific Computation’s efforts to revitalize the Computational Sciences Certificate Program by including the following courses from the Department of Computer Science and Engineering in its curriculum:

- CPSC 603, Database Systems and Applications
- CPSC 605, Compiler Design
- CPSC 620/VIZA 671, Computational Geometry
- CPSC 626, Parallel Algorithm Design and Analysis – CPSC 654, Supercomputing
- CPSC 659/ECEN/659, Parallel/Distributed Numerical Algorithms and Applications
- CPSC 660/MATH 660, Computational Linear Algebra

Should you have any questions or concerns, please feel free to contact me.
Hello,
Yes it is acceptable to list these classes. I had to check with the new DH in OCEN and he agrees.
Thanks
Robin

Sent from my iPad

On Oct 15, 2015, at 8:26 AM, Shumbera, R. Bradley <shumbera@tamu.edu> wrote:

Dr. Autenrieth,

Could you please update regarding my request from 10/7 (included below)?

R. Bradley Shumbera, Ph.D. | Assistant Director
Institute for Scientific Computation | Texas A&M University
3404 TAMU | College Station, TX 7743-3404

ph: 979.458.0448 | mobile: 979.224.4415 | fax: 979.862.3983
shumbera@tamu.edu | http://isc.tamu.edu/

Developing Computational Technology to Advance Science & Engineering

From: Shumbera, R. Bradley
Sent: Wednesday, October 7, 2015 1:51 PM
To: Autenrieth, Robin <rautenrieth@civil.tamu.edu>
Subject: Computational Sciences Certificate Program Changes

Dr. Autenrieth,

The Institute for Scientific Computation is currently working to update its Computational Sciences Certificate program. This program targets science and engineering graduate students, providing them with formal documentation on their transcript that they successfully completed courses targeted at the computational sciences to supplement their degree. To promote increased student participation, we are updating the program’s curriculum by adding additional elective choices that will satisfy program requirements. Based on the recommendation of Dr. Chen, we are interested in adding the following courses from your department:

-- CVEN 680, Advanced Computation Methods for Fluid Flow
-- CVEN 688, Computational Fluid Dynamics

Would you kindly provide a short statement indicating your support for this move on departmental letterhead? Below you can find suggested wording you can use.
“I support the Institute for Scientific Computation’s efforts to revitalize the Computational Sciences Certificate Program by including the following courses from the Department of Civil Engineering in its curriculum:

-- CVEN 680, Advanced Computation Methods for Fluid Flow
-- CVEN 688, Computational Fluid Dynamics”

If you have any questions or concerns, please feel free to contact me.

Best Regards,

R. Bradley Shumbera, Ph.D. | Assistant Director
Institute for Scientific Computation | Texas A&M University
3404 TAMU | College Station, TX 7743-3404

ph: 979.458.0448 | mobile: 979.224.4415 | fax: 979.862.3983
shumbera@tamu.edu | http://isc.tamu.edu/

Developing Computational Technology to Advance Science & Engineering
THE COLLEGE OF GEOSCIENCES
DEPARTMENT OF GEOLOGY & GEOPHYSICS

Dr. Michael Pope
Professor and Head

Inclusion of GEOP 620, Geophysical Inverse Theory in Computational Sciences Certification

October 7, 2015

To Whom it May Concern:

I support the Institute for Scientific Computation’s efforts to revitalize the Computational Sciences Certificate Program by including GEOP 620, Geophysical Inverse Theory from the Department of Geology and Geophysics in its curriculum.

Sincerely,

[Signature]

Dr. Michael C. Pope
Professor and Head
Department of Geology and Geophysics

108AA Halbouty Hall
3115 TAMU
College Station, TX 77843-3115
Ph: 979.845.4376 FAX: 979.845.6162
mcpope@tamu.edu
To Whom It May Concern:

I support the Institute for Scientific Computation's efforts to revitalize the Computational Sciences Certificate Program by including the following courses from the Department of Mathematics in its curriculum:

- MATH 609, Numerical Analysis
- MATH 610, Numerical Methods in Partial Differential Equations
- Math648, Computational Algebraic Geometry
- MATH 660/CSCE 660, Computational Linear Algebra
- MATH 661, Mathematical Theory of Finite Element Methods
- MATH 676, Finite Element Methods in Scientific Computing

Sincerely,

[Signature]

Emil J. Straube
Professor and Head
Shumbera, R. Bradley

From: Andreas Polycarpou
Sent: Thursday, October 15, 2015 8:42 AM
To: Shumbera, R. Bradley; Kate Goodman
Subject: Re: Computational Sciences Certificate Program Changes

Dear Dr. Schumbera

"I support the Institute for Scientific Computation's efforts to revitalize the Computational Sciences Certificate Program by including MEEN 672, Introduction to Finite Element Method, from the Department of Mechanical Engineering in its curriculum."

Thanks, Andreas

Andreas A. Polycarpou, Ph.D.
Department Head & Meinhard H. Kotzebue '14 Professor
Texas A&M University
Department of Mechanical Engineering
100 Mechanical Engineering Building, 3123 TAMU
College Station, TX 77843-3123
Tel (979) 458 - 4061; Fax (979) 845 - 3081
E-mail: tamu-me-head@mengr-tamu.org
Dept Web Site: http://www.mengr.tamu.edu
Shumbera, R. Bradley

From: Hassan, Yassin A
Sent: Thursday, October 15, 2015 11:58 AM
To: Shumbera, R. Bradley; Burks, Andrea L
Cc: Ragusa, Jean C
Subject: RE: Computational Sciences Certificate Program Changes
Importance: High

Dear Dr. Shumbera,

This is to inform you the Department of Nuclear Engineering supports the Institute for Scientific Computation’s efforts to revitalize the Computational Sciences Certificate Program by including NUEN 618, Multiphysics Computations in Nuclear Science and Engineering, from the Department of Nuclear Engineering in its curriculum.

Should you need more information, please contact me.
Thanks,
Yassin

Yassin A. Hassan
Department Head, Nuclear Engineering
Sallie and Don Davis ‘61 Professor of Engineering
Editor-in-Chief of Nuclear Engineering and Design Journal
Texas A&M University
MS 3133
College Station, Texas 77843-3133
Phone: 979 845 7090
Cell: 979 218 4417
Email: y-hassan@tamu.edu
October 14, 2015

To Whom It May Concern

I support the Institute for Scientific Computation’s efforts to revitalize the Computational Sciences Certificate Program by including OCNG 615, Numerical Modeling of Ocean Circulation I, from the Department of Oceanography in its curriculum.

Please let me know if I may be of any assistance in enhancing this transformative educational program.

Sincerely,

Debbie Thomas
October 7, 2015

R. Bradley Shumbera, Ph.D.
Assistant Director
Institute for Scientific Computation
Texas A&M University
3404 TAMU
College Station, TX 7743-3404

Dear Dr. Shumbera:

I support the Institute for Scientific Computation’s efforts to revitalize the Computational Sciences Certificate Program by including PETE 656, Advanced Numerical Methods for Reservoir Simulation from the Harold Vance Department of Petroleum Engineering in its curriculum.

If you have any questions or concerns, please feel free to contact me.

Sincerely,

A. Daniel Hill
Department Head
Noble Endowed Chair
October 7, 2015

R. Bradley Shumbera, Assistant Director
Institute for Scientific Computation
Texas A&M University
3404 TAMU
College Station, TX 7743-3404

Dear Dr. Shumbera,

I support the Institute for Scientific Computation's efforts to revitalize the Computational Sciences Certificate Program by including the following courses from the Department of Statistics in its curriculum:

-- STAT 604, Topics in Statistical Computations
-- STAT 605, Advanced Statistical Computations
-- STAT 608, Regression Analysis
-- STAT 626, Methods in Time Series Analysis
-- STAT 636, Applied Multivariate Analysis

Sincerely,

Valen Johnson
Professor and Head
Department of Statistics
Texas A&M University