23-12

Proposal for New Undergraduate or Graduate Minor

CREATION OF:

1. x Undergraduate Minor □ Graduate Minor
2. Name of the proposed minor: ____Applied Mathematics_____
3. Primary College: _LAS___ Secondary College: ___N/A____
4. Involved Department(s): _____Mathematics_____
5. Name and email address of Administrator, Academic Unit or group originating the proposal:
   Name: ___Eric Weber_____ email address: ___esweber@iastate.edu___
6. General description of the minor: This minor will train students in applied and computational aspects of mathematics to enhance the value of their primary major.
7. Rationale for creation of this minor: There are many students who take a large number of credits in MATH to complete degree requirements in engineering, computer science, physics, and other majors. These students have interests in the more applied and computational aspects of mathematics. The existing minor in mathematics focuses on formal proofs-based mathematics, requiring MATH 201 (Introduction to Proofs) and other proofs-based courses. The Department of Mathematics would like to make it possible for those students to have the opportunity to earn a minor that better serves their academic and professional goals.
8. Objectives of the proposed minor including the student learning outcomes and how the learning outcomes will be assessed: Students from other majors will accomplish learning outcomes by taking additional courses which will train them in the techniques and tools of applied mathematics. As is typical in math courses, outcomes will be assessed through homework, quizzes, exams, and/or projects.

After completing the minor in Applied Mathematics, students will demonstrate:

- an understanding of multivariable calculus and differential equations as necessary to model physical phenomena;
- an understanding of linear algebra as necessary to analyze data, systems, and processes;
- an ability to solve computational problems relevant to their interests using the

techniques of applied mathematics.

9. Relationship of the minor to other programs at Iowa State University:

The program would require a total of 5 courses consisting of the following

- MATH (207 or 317), 265, and (266 or 267)
- Two additional courses from a selection of 300-400 level mathematics courses

There are multiple programs across campus that require some of these courses for their majors. For example, most engineering programs require both 265 and 267; several programs in ECE also require 207; STAT requires 207 (or 317 as an alternative). Several programs also recommend some of these courses to students (such as CS, which recommends 207, 304, 314 as electives), but none that require all of them.

While there is substantial overlap with the existing Mathematics minor, the proposed Applied Mathematics minor will serve a different student population. The existing minor in Mathematics focuses on formal proofs-based mathematics, requiring MATH 201 (Introduction to Proofs) and other proofs-based courses. Students may earn the Mathematics undergraduate minor or the Applied Mathematics Undergraduate minor, but not both; Mathematics undergraduate majors are not eligible for either minor.

Current university minor requirements dictate that students must take at least 9 credits for the minor that do not count for any other degree requirements; starting in 2025-26, the number of stand-alone credits for minors will decrease to 3 credits. As far as we are aware, only ECE requires 3 of the courses from among the new program requirements. As such, the primary students that we think would be interested in this program—ENG, CS, STAT, PHYS, DS, GEAT—are well positioned to fulfill the 5 course requirement while ensuring that 9 credits are not double counted. Once the stand-alone requirement is reduced to 3 credits the minor will be more easily obtainable by other majors such as those in ECE programs.

10. Relationship of the minor to the strategic plans of the university, of the college, and of department or program:

The program would contribute to a scientifically capable workforce. The Mathematics Department frequently hears from stakeholders in industry that students with competency in applied and computational mathematics are in demand. Students at Iowa State University are already able to take relevant coursework to obtain these skills; however, this program would provide students with the credentials that are desired by organizations that recruit ISU graduates. The courses that meet the requirements for this program already have healthy enrollments of students in engineering, computer science, statistics, and physics. However, they currently have no opportunity to obtain the credentials associated with the course content, other than the courses appearing on their transcripts.

The reason for this discrepancy is that currently to obtain a Mathematics major or minor, students must take several proofs-based courses. The students from outside mathematics are frequently more interested in computational and applied aspects of mathematics, rather than proofs-based concepts. Providing the opportunity for this credential will increase student demand for these courses, as well as better position them to be competitive in industry.

11. Comparison of the proposed minor with similar programs at other Regent's institutions: University of Northern Iowa and University of Iowa do not have a similar minor. University of Iowa only has a mathematics minor as we currently do, and University of Northern Iowa has several targeted minors (data science, teaching, actuarial science) but not a broad minor in applied mathematics.

12. Program requirements and procedures, including:
    a. prerequisites for prospective students;

       N/A

    b. application and selection process;

       N/A

    c. language requirements (if applicable)

       N/A

    d. courses presently available for credit toward the program;

       All listed courses for the minor are presently available. The program would require a total of 5 courses consisting of the following

       - MATH 207 or 317
       - MATH 265
       - MATH 266 or 267
       - One additional course from MATH 314, 365, 385, 407, 423, 481
       - One additional course from MATH 304, 314, 341, 365, 373, 385, 407, 421, 423, 424, 469, 481

    e. proposed new courses or modifications of existing courses;

       None

    f. advising of students;

       The same as current math minor students

13. General description of the resources currently available and future resource needs, in terms of:
    a. faculty members;
    b. computers, laboratories, and other facilities;

c. library facilities (journals, documents, etc.) in the proposed area;

d. supplies, field work, student recruitment, etc.

No additional resources will be needed for this new minor except the possibility of adding additional sections of high-demand courses.

14. Describe the needs for new resources and/or reallocated resources. Attach to the program proposal memos from the department chair(s), the college dean(s), and other appropriate persons, agreeing to the allocation of new resources and/or the reallocation of resources.

We estimate that with current course offerings and demand, this program can accommodate approximately 50 new students with no new sections offered. Should the program grow moderately larger than that (on the order of 100), new sections of high-demand courses can be offered through internal departmental reallocations of teaching power. Should the program grow substantially larger than that, the department would likely need additional teaching power to accommodate program requirements.

15. Attach to the program proposal letters of support, recommendations, and statements, when appropriate, from programs and departments at ISU which are associated with the proposed program or have an interest in the proposed program. Letters of support from external stakeholders may also be included.

We have attached support letters from Statistics, Computer Science, and the College of Engineering Curriculum Committee.

16. If the new program is interdisciplinary, a governance document should be created and submitted to the Associate Provost for Academic Programs. Indicate here that it has been completed.

N/A as this program is not interdisciplinary.

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

To: Eric Weber, Mathematics Chair

From: Dan Nettleton, Statistics Chair

Date: January 24, 2023

Subject: Proposed Undergraduate Minor in Applied Mathematics

I wish to express my full support for the proposed undergraduate minor in Applied Mathematics. The reasoning behind the proposal is sound, and the proposed minor would be of interest and valuable to undergraduate students majoring in a variety of areas, including Statistics. Please let me know if I can lend support to your proposal in other ways.

Academic Program Approval Voting Record

This document is to be appended as the last page of the proposal for any new or revised academic program to record the successive votes of approval as the proposal moves through its required review and approval steps. Consult Faculty Handbook Section 10.8 or the Faculty Senate Curriculum Committee website for information regarding Committee review and voting requirements for each action.

Curricular Action: (check appropriate boxes below)

1. ☒ New Program □ Name Change □ Discontinuation □ Concurrent Degree for:
2. □ Undergraduate Major □ Graduate Major ☒ Undergraduate Minor □ Graduate Minor
   □ Undergraduate Certificate □ Graduate Certificate □ Other: _____
3. Name of Proposed Change: _____Minor in Applied Mathematics_____
4. Name of Contact Person: Claus Kadelka e-mail address: kadelka@iastate.edu
5. Primary College: LAS Secondary College: _____
6. Involved Department(s): MATH _____ _____

Voting record for this curricular action:

Voting Body	Votes			Date of Vote
	For	Against	Abstain	
Dept. or Program Committee	29	2	4	02/17/2023
LAS College Curriculum Committee	6	0	0	9/8/2023
College Approval Vote:				
--Faculty Representative Assembly	22	0	1	10/24/2023
Graduate Council	N/A	N/A	N/A	
Faculty Senate Curriculum Committee	6	0	0	11/9/2023
Faculty Senate Academic Affairs Council	8	0	0	11/16/2023
Faculty Senate				

Subject: Re: Applied math minor proposal
Date: Monday, January 30, 2023 at 8:41:22 PM Central Standard Time
From: Rajan, Hridesh [COM S]
To: Weber, Eric [MATH]
CC: Chaudhuri, Soma [COM S], Holmes, Deborah K [LASAS]

Eric,

Thank you for sending me this applied math minor proposal. I appreciated learning about this new minor. I believe it would be of interest to several Computer Science majors since they can fulfill the minor requirement by taking courses that are all electives for CS majors. So, I am very supportive of your minor proposal.

Best wishes,
Hridesh

Dr. Hridesh Rajan
Professor and Chair
Department of Computer Science
Iowa State University of Science and Technology
https://www.cs.iastate.edu/hridesh

From: Eric Weber <esweber@iastate.edu>
Date: Thursday, January 19, 2023 at 5:30 PM
To: "Rajan, Hridesh [COM S]" <hridesh@iastate.edu>
Subject: Applied math minor proposal

Hridesh,
Attached please find the proposal for a new applied math minor. If you care to comment on it, both informally and also for inclusion in the proposal, feel free to do so. Your students could satisfy the requirements for the minor by taking courses that are all electives for CS majors: 207, 265, 266 or 267, 304, 314.
Thanks,
Eric.

Professor and Chair of Mathematics
Iowa State University
https://faculty.sites.iastate.edu/esweber/

Subject: Re: Applied math minor proposal
Date: Wednesday, February 8, 2023 at 9:02:32 AM Central Standard Time
From: Schwartz, Christian J [M E]
To: Weber, Eric [MATH]

Eric,

I asked ECCC to take a look at the minor proposal and to provide their feedback. Based on their comments, I can provide the following statement:

The proposed minor would most likely be of interest to students in the College of Engineering, and there do not appear to be any curricular barriers for interested students to complete the minor. Some programs feel that there is a substantial need for engineering students to complete this minor in order to improve their education and competitiveness when seeking employment. It is not possible at this time to estimate the number of engineering students who would enroll in the minor, but as stated above there appear to be no obstacles in terms of course prerequisites that would hinder interested engineering students from completing it.

Let me know if you need anything else, or more detail on any particular point.
-Cris

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Cris Schwartz, PhD, PE
Professor | Director of Undergraduate Studies
Iowa State University | Department of Mechanical Engineering
2024 Black Engineering Bldg. | Ames, IA 50011
Phone: 515.294.2866 | Email: cris1@iastate.edu
https://www.me.iastate.edu/faculty/?user_page=cris1

From: Weber, Eric [MATH] <esweber@iastate.edu>
Sent: Friday, February 3, 2023 12:06 PM
To: Schwartz, Christian J [M E] <cris1@iastate.edu>
Subject: Re: Applied math minor proposal

Cris,
Would you be able to write a few sentences in support of our proposal?
Thanks,
Eric.

From: Eric Weber <esweber@iastate.edu>
Date: Thursday, January 19, 2023 at 5:35 PM
To: "Schwartz, Christian J [M E]" <cris1@iastate.edu>
Subject: Applied math minor proposal

Cris,
Attached please find the proposal for a new applied math minor. If you care to comment on it, both informally and also for inclusion in the proposal, feel free to do so.

Thanks,
Eric.

Professor and Chair of Mathematics
Iowa State University
https://faculty.sites.iastate.edu/esweber/