Term Information

Effective Term	Autumn 2018

General Information

Course Bulletin Listing/Subject Area	Mathematics
Fiscal Unit/Academic Org	Mathematics - D0671
College/Academic Group	Arts and Sciences
Level/Career	Undergraduate
Course Number/Catalog	4420
Course Title	Capstone Course for Integrated Major in Mathematics and English
Transcript Abbreviation	IMME Capstone
Course Description	Students combine the Mathematics and English knowledge and skills they have acquired in the integrated major through a capstone experience.
Semester Credit Hours/Units	Fixed: 3

Offering Information

Length Of Course	14 Week
Flexibly Scheduled Course	Never
Does any section of this course have a distance education component?	No
Grading Basis	Letter Grade
Repeatable	No
Course Components	Lecture
Grade Roster Component	Lecture
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus

Prerequisites and Exclusions

Prerequisites/Corequisites	IMME senior standing or permission of instructor.
Exclusions	Not open to students with credit for English 4420

Cross-Listings

Cross-Listings	Cross-listed in English

Subject/CIP Code

Subject/CIP Code	27.0101
Subsidy Level	Baccalaureate Course
Intended Rank	Senior

Requirement/Elective Designation

Required for this unit's degrees, majors, and/or minors

Course Details

Course goals or learning objectives/outcomes

- Students will have understanding of their own personal strengths and which jobs might require their particular set of skills.
- Students will learn how literary study can benefit from the skillset of a mathematician.
- Students will learn how a humanistic approach is valuable for both communicating, and understanding the context of, ideas in the mathematical sciences.

Content Topic List

- Rhetoric: How to Employ Linguistic Sleight of Hand
- Proof: From correct to convincing
- The Poem: How to Work with Pattern and Form
- Elementary geometry: Euclidean and beyond
- The Novel: How to Read Using Mathematical Models
- Population biology: the first mathematical models
- Biography: How to Order the Chaos of a Life
- History of probability

Attachments

- English:Math 4420 Capstone Course-revison03242017.docx: Syllabus-Revised

  (Syllabus. Owner: Husen,William J)
- IMME Curriculum maps_revison03242017.docx: IMME Curriculum Map

  (Other Supporting Documentation. Owner: Husen,William J)

Comments

- Revised syllabus contains project outline per revision request. Curriculum map for IMME not included in original submission but submitted here. This course is part of the IMME program submission. *(by Husen,William J on 03/24/2017 03:13 PM)*
- See 1-24-17 feedback email to B. Husen. *(by Vankeerbergen,Bernadette Chantal on 01/24/2017 01:40 PM)*
- Will you be changing references to IDEM in the program proposal to IMME at a future date? *(by Haddad,Deborah Moore on 11/29/2016 11:44 AM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Husen,William J	11/29/2016 10:47 AM	Submitted for Approval
Approved	Husen,William J	11/29/2016 10:48 AM	Unit Approval
Approved	Haddad,Deborah Moore	11/29/2016 11:44 AM	College Approval
Revision Requested	Vankeerbergen,Bernadette Chantal	01/24/2017 01:40 PM	ASCCAO Approval
Submitted	Husen,William J	03/24/2017 03:13 PM	Submitted for Approval
Approved	Husen,William J	03/24/2017 03:13 PM	Unit Approval
Approved	Haddad,Deborah Moore	03/24/2017 03:56 PM	College Approval
Pending Approval	Nolen,Dawn Vankeerbergen,Bernadette Chantal Hanlin,Deborah Kay Jenkins,Mary Ellen Bigler	03/24/2017 03:56 PM	ASCCAO Approval

Capstone Course for the Integrated Major in Mathematics and English (4420)

Profs. Daniel J. Thompson (Math)

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Math 4420, Cross-listed as English 4420

Bulletin Description: Math 4420/English 4420: IMME Capstone

Students combine the Mathematics and English knowledge and skills they have acquired in the integrated major through a capstone experience. **Prerequisites:** IMME senior standing or permission of instructor.

Rationale

Students pursuing the Integrated Major in Mathematics and English will learn concepts, develop understanding of theories, and acquire techniques and skills in a variety of courses in Math and English. In their senior year, all integrated majors will take a capstone course that will provide an opportunity to combine and apply the full range of knowledge and skills they have acquired through their previous courses.

Learning Goals

Students who complete this capstone course will have a broader understanding of their own personal strengths and which jobs might require their particular set of skills, thus resulting in a student who is more prepared for entering the workforce. Furthermore, students will learn how literary study can

benefit from the skillset of a mathematician, and how a humanistic approach is valuable for both communicating, and understanding the context of, ideas in the mathematical sciences.

The course will be team-taught by Daniel J. Thompson from the Math Department, and Zoë Brigley Thompson in the English Department.

Topics Covered

Introduction: Writing Skills in Math and English

(Taught by Z.B.T and D.J.T.)

The course will open with Z.B.T and D.J.T. team-teaching a week that offers a crash course on writing skills not only in English, but also in Mathematics.

1. **Rhetoric**

   a. **Rhetoric: How to Employ Linguistic Sleight of Hand**

      (Taught by Z.B.T)

This section focuses on rhetoric, and the use of linguistic devices to persuade, influence and convert. It is essential for real-world communication skills to understand how these techniques work, and how students can use them to strengthen their delivery of particular information.

Set text: *Julius Caesar* by William Shakespeare and the film *Julius Caesar* (1953)

   b. **Proof: From correct to convincing**

      (Taught by D.J.T)

A mathematical theorem is a journey from a collection of hypotheses to a non-trivial conclusion. A proof of a theorem aims to convince a reader of the mathematical steps required to make this journey. There is a gulf between a proof that contains the right ingredients in the right order, and a clear exposition that communicates the ideas in an optimal way. An “optimal” proof is a matter of style and personal taste, and is where the art comes into mathematical writing. We will look at these issues in the context

of some proofs from elementary number theory and geometry. These skills will be useful for any kind of technical writing.

Set text: Lecture notes based on *Foundations of Mathematics* by Stewart and Hall

2. Rules and structure

a. The Poem: How to Work with Pattern and Form

(Taught by Z.B.T.)

This section will introduce students to a number of forms in poetry, and it will provoke discussion about pattern and form in language. Different forms will be considered such as the sestina which uses repeated end words; the sonnet which uses rhyme, meter, and other strictures; and cynghanedd which dictates repeated consonantal sounds and assonance. How do the strictures and patterns of poetic form shape thought and language? When part of the structure is there, how do writers go about filling in the blanks? The ability to complete patterns is a key aspect of creative and critical thinking, which is a key skill in real-world scenarios.

Set texts: a collection of poems including forms such as the sonnet, sestina, the pantoum, terza rima, and cynghanedd.

b. Elementary geometry: Euclidean and beyond

(Taught by D.J.T)

We will look at the incredible mathematics of the Greeks, including Euclid's axioms for geometry, and how these are used in proofs. Axioms can be thought of as a set of rules to determine a mathematical playground. Of particular interest is Euclid's parallel postulate (In a plane, given a line and a point not on it, there is a unique parallel line through that point), which he initially believed to be a consequence of the other axioms. A major development in the history of mathematics was the realization that the parallel postulate is independent of the axioms of Euclidean geometry, and can be replaced by alternative rules on parallel lines, leading to different geometries, i.e. projective geometry (infinitely many parallel lines) and spherical geometry (no parallel lines).

Set text: Lecture notes based on Jeremy Gray's History of Mathematics

3. Mathematical models

a. The Novel: How to Read Using Mathematical Models

[Taught by Z.B.T.]

Drawing on Franco Moretti's notion of "distant reading," this section will consider how one might read the novel differently using a more mathematical kind of mapping. Moretti employs graphs from quantitative history, maps from geography, and trees from evolutionary theory. We will apply Moretti's theories to the set texts, a technique which again relies on recognizing patterns as well as mapping spaces and events.

Set text: *The Great Gatsby* by F. Scott Fitzgerald

b. Population biology: the first mathematical models

(Taught by D.J.T)

We look at the early history of mathematical modeling in Biology: a new era was started when the gloomy English cleric Malthus wrote down an alarming equation for population growth. We will critique Malthus' model and look at Verhulst's more realistic Logistic model. We will discuss the benefits and points of caution of mathematic models in the natural sciences.

Set text: Lecture notes based on *Mathematical Models in Biology* by Edelstein-Keshet.

4. Randomness

a. Biography: How to Order the Chaos of a Life

[Taught by Z.B.T.]

How can we measure the random events of a life? Is there such a thing as fate, or is the course of human existence defined by anarchy and chaos? By looking at the biography of a particular mathematician, Alan Turing, we will consider not only his mathematical contribution, or the poignant events of his life, but also how his story is written and interpreted by the biographer. We will consider how the biographer organizes the narrative before him, and how the mere act of writing of a biography is a philosophical endeavor that imposes order on chaos. We will consider the choices made in writing about what detail to include and what to omit, and how the writer is always having to make choices about what is significant and worthy of attention, and what is not.

Set text: *Alan Turing: An Enigma* by Andrew Hodges and the film *The Imitation Game* (2015).

b. History of probability

(Taught by D.J.T)

We will look at the journey from deterministic to probabilistic mathematics embodied by mathematicians such as Pascal and Fermat. Initially, this study was motivated by a desire to understand gambling games popular in French society. Later on, the importance of these techniques to core mathematics and the natural sciences was understood, and developed by great mathematicians such as Laplace and Kolmogorov.

Course Conclusion

The conclusion to the course will include visits from business contacts from the Buckeye Leadership Fellows Program (Office of Student Life); a panel will see the students give a final presentation. Although the panel will provide feedback on the presentation, all grades will be assigned by the class instructor.

Assignments

Assignment	**Percentage**
Attendance and Class Contribution	10%
Midterm	25%
Presentation	15%
Capstone Project	50%

Midterm

The midterm will include a close analysis requiring knowledge of rhetorical and literary terms, and a demonstration of the ability to write clear and convincing proofs of simple results from elementary number theory and geometry.

Capstone Project

The course provides students with both a critical learning experience and an opportunity to synthesize and apply what they learned throughout the program. The final project is based on one of the four topics covered on the course. Students will be given a list of possible projects at the beginning of each section of the course, and they will be able to decide which element they would like to work on. The project will involve the often under-appreciated humanistic side of mathematics, with students encouraged to focus on an area of mathematics in its historical context; combining both a focus on exposition of ideas and its context in societal and philosophical change. This will be combined with an English project that involves engaging with linguistic devices, literary genres, and critical analysis.

Examples of projects:

Projects should incorporate mathematical and humanities components. This can be achieved in one of two ways:

(a) the critical analysis and the mathematics can be blended into one project. History of Mathematics projects would be particularly suited to this. For example, a project on the history of gambling in 17th century France, including analysis of a relevant text, with mathematical content given by exploring some of the mathematical contributions of Pascal and Fermat.

(b) the critical analysis and the mathematics components can be handled separately, but with some coherence in the choice of topics: e.g. a project on Topic 3. could incorporate a first part which uses Moretti's theories of mathematical models to analyze a text, and a second part which looks at a simple mathematical model in applied mathematics.

Under these criteria, there is a lot of latitude to choice appropriate projects.

In Topic 1 (Rhetoric), many projects of type (b) are possible through analysis of rhetoric in a suitable text, and exposition of a short proof from a classic text in mathematics.

In Topic 2 (Rules and structure), a project of type (b) could be suitable with a first part analyzing form in

poetry, and with a second part analyzing some axioms (say, of the natural numbers, or Euclidean geometry, etc). This topic also lends itself to an integrated historical project of type (a). For example, there is a fascinating historical back story to the discovery of projective geometry by Poncelet. This would be suitable for a history of mathematics project explaining both the mathematical ideas, and critical analysis involving literature from the time and societal context.

In Topic 3 (Mathematical Models), we already mentioned an example project: a first part which uses Moretti's theories of mathematical models to analyze a text, and a second part which looks at a simple mathematical model in applied mathematics.

In Topic 4 (Randomness / Biography): the choice of historical projects is limitless. There are many works on biography of fascinating mathematicians. An investigation of Turing's biography combined with an explanation of some of his mathematics would be a great project. A project based on the new book "Hidden Figures" by Margot Lee Shetterly concerning the contribution of black female mathematicians to NASA in the 1940's would also be a fantastic and timely project.

Timeline for projects:

We will discuss possible projects at the beginning of the course. Students who choose topics from later in the course will be able to plan with this in mind. The projects are really for independent study, particularly the biography oriented projects from the end of the course, so we see no problem with the projects being initiated early in the course in discussion with the class instructors, with material being reinforced as we cover these topics in class.

Schedule of Topics:

We work on the assumption that there are twelve 110 minute classes.

Week 1: Introductory lectures: On the integration of the humanities and the mathematical sciences

Week 2: Rhetoric I

Week 3: Rhetoric II

Week 4: Rules and structure I

Week 5: Rules and structure II

Week 6: Midterm

Week 7: Mathematical models I

Week 8: Mathematical models II

Week 9: Randomness I

Week 10: Randomness II

Week 11: Presentations

Week 12: Presentations and concluding remarks

Catalog description:

The Capstone Course for the Integrated Major in Mathematics and English is at the intersection of these seemingly distinct fields. The focus is on commonalities and analogies between literary study and skills valuable in the mathematical sciences. Topics include writing styles in both English and Mathematics, structures in English and Math (form in poetry vs axioms in mathematics), and history and philosophy of mathematics from both a literary and scientific stand point.

This 3-credit course will meet once a week for a 110 minute class.

Purpose of course:

The purpose of the course is to demonstrate the full range of skills acquired through the Math and English curriculum, and to appreciate the value of a humanities background for certain scientific skills, and vice versa. Students will demonstrate skills that are valuable for employers by combining rigorous analytic skill, with the ability to communicate ideas, and understand ideas in societal context.

Textbook:

The math component will be based on new lecture notes using various sources as described in the course description. The English component will be based on various set texts as described in the course description.

Prerequisite:

The course is designed for students in the final year of IMME.

Disability Statement:

Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated, and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone (614) 292-3307 and VRS (614) 429- 1334; webpage http://www.ods.ohio- state.edu.

Academic Misconduct Statement:

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term academic misconduct includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee. For additional information, see the Code of Student Conduct: http://studentaffairs.osu.edu/resource