



New York City College of Technology

The City University of New York

DEPARTMENT: Mathematics

PREPARED BY: Professor Andrew Douglas

COURSE: MEDU 2010

TITLE: Technology in Mathematics Education

DESCRIPTION: Students will examine the rationale and pedagogy for the effective use of technology in the middle and high school mathematics classrooms. The technologies considered may include graphing calculators, computer algebra systems, spreadsheets, and dynamic geometry software.

CREDIT HOURS: 1 cl hrs, 2 lab hrs, 2 cr

PREREQUISITES: MEDU 1021; and MAT 1475

TEXTS:

- [1] Gerard A. Venema. "Exploring Advanced Euclidean Geometry with GeoGebra." MAA, 2013.
- [2] NCTM Principles and Standards for School Mathematics, 2010.

ADDITIONAL REFERENCES:

- [3] New York State Common Core Learning Standards for Mathematics  
[http://www.p12.nysed.gov/ciai/common\\_core\\_standards/pdfdocs/nysp12cclsmath.pdf](http://www.p12.nysed.gov/ciai/common_core_standards/pdfdocs/nysp12cclsmath.pdf)
- [4] Mathematics Education Handbook  
<https://sites.google.com/site/andrewdouglas/Fundamentals.pdf>
- [5] Texas Instruments Graphing Calculator Activity Repository  
<http://education.ti.com/en/us/activity/search/subject>
- [6] GeoGebra Tube (a repository of lesson plans and activities for GeoGebra).  
<https://tube.geogebra.org>
- [7] Samples of Applet Construction using GeoGebra  
[www3.ul.ie/cemtl/Booklets/Examples\\_Web.pdf](http://www3.ul.ie/cemtl/Booklets/Examples_Web.pdf)

REQUIRED SOFTWARE AND HARDWARE: GeoGebra, Maple, TI-83 Plus or TI-84 Plus graphing calculator.

LEARNING OUTCOMES: Upon successful completion of the course, students should be able to:

1. Solve a wide range of mathematical problems using technology
2. Use technology to assist in making and testing conjectures
3. Prove mathematical theorems with technology
4. Create programs or applications to perform mathematical functions, and solve mathematical

- problems
5. Create mathematics lesson plans, consistent with the CCSSM standards and NCTM technology principle, that effectively incorporate technology

<b>INSTRUCTIONAL OBJECTIVES</b> For successful completion of the course, students should be able to:	<b>ASSESSMENT</b>
Solve a wide range of mathematical problems using technology	<ul style="list-style-type: none"> <li>• Student created lesson plans</li> <li>• Student presentations</li> <li>• Student guided, in-class lessons</li> <li>• Final exam</li> </ul>
Use technology to assist in making and testing conjectures	<ul style="list-style-type: none"> <li>• In class discussions</li> <li>• Assignments</li> <li>• Student guided, in-class lessons</li> <li>• Final Exam</li> </ul>
Use technology to assist in making and testing conjectures	<ul style="list-style-type: none"> <li>• Assignments, group work, final exam.</li> </ul>
Create programs or applications to perform mathematical functions	<ul style="list-style-type: none"> <li>• Assignments, group work, final exam.</li> </ul>
Create programs or applications to solve mathematical problems	<ul style="list-style-type: none"> <li>• Assignments, group work, final exam.</li> </ul>
Prove mathematical theorems with technology	<ul style="list-style-type: none"> <li>• Assignments, group work, final exam.</li> </ul>
Create mathematics lesson plans, consistent with the CCSSM standards and NCTM technology principle, that effectively incorporate technology	<ul style="list-style-type: none"> <li>• Student created lesson plans</li> <li>• Student guided, in-class lessons</li> <li>• Final exam</li> </ul>

<b>GENERAL EDUCATION LEARNING OUTCOMES</b>	<b>ASSESSMENT</b>
Gather, interpret, evaluate, and apply information discerningly from a variety of sources.	Classroom discussion, writing assignments, student presentations, tests, exams.
Understand and employ both quantitative and qualitative analysis to solve problems.	Classroom discussion, writing assignments, student presentations, tests, exams.
Employ scientific reasoning and logical thinking.	Classroom discussion, writing assignments, student presentations, tests, exams.
Acquire tools for lifelong learning.	Classroom discussion, writing assignments, student presentations, tests, exams.
Work with teams. Build consensus and use creativity.	Classroom discussion, writing assignments, student presentations, tests, exams.
Use creativity to solve problems.	Assignments, group work.

**GRADING PROCEDURE:**

- Student created lesson plans
- Student guided, in-class lessons
- Final exam
- Class participation
- Mathematical and Pedagogical Assignments
- Portfolios

**TEACHING AND LEARNING METHODS:**

- Guided discussion
- Guided problem solving/discovery
- Group work
- Student guided lessons

**WEEKLY COURSE OUTLINE:**

<b>SESSION</b>	<b>TOPIC</b>	<b>REFERENCE</b>
<b>INTRODUCTION</b>		
1, 2	<ul style="list-style-type: none"> <li>• NCTM standards and technology</li> <li>• CCSM and technology</li> <li>• Review of writing lesson plans</li> <li>• Review of Bloom's Taxonomy</li> </ul>	[2], [3], [4]
<b>UNIT I. DYNAMIC GEOMETRY SOFTWARE: GEOGEBRA</b>		
3	Review of Elementary Euclidean Geometry	[1]
4-5	Introduction to GeoGebra <ul style="list-style-type: none"> <li>• The GeoGebra toolbar</li> <li>• Simple constructions and the drag test</li> <li>• Measurement and calculation</li> <li>• Enhancing sketches</li> </ul>	[1]
6-8	The Classical Triangle Centers <ul style="list-style-type: none"> <li>• Concurrent lines</li> <li>• Medians and the centroid</li> <li>• Altitudes and orthocenter</li> <li>• Perpendicular bisectors and circumcenter</li> <li>• The Euler line</li> </ul>	[1]
9-10	Advanced Techniques in GeoGebra <ul style="list-style-type: none"> <li>• User defined tools</li> <li>• Check boxes</li> <li>• The Pythagorean Theorem</li> <li>• Proofs without Words</li> </ul>	[1], [6]
11-12	The Medial and Orthic Triangles <ul style="list-style-type: none"> <li>• The medial triangles</li> <li>• The orthic triangles</li> <li>• Cevian triangles</li> <li>• Pedal triangles</li> </ul>	[1]
13	Conic Sections	[6]

<b>UNIT II. APPS AND APPLETS IN MATHEMATICS EDUCATION</b>		
14-16	<p>Overview of available applications for mathematics education. Examples may include:</p> <ul style="list-style-type: none"> <li>• Wolfram Alpha</li> <li>• Geoboard</li> <li>• Pattern Blocks by Brainingcamp</li> <li>• Buzzmath Middle School</li> <li>• ClassDojo</li> <li>• Common Core Standards</li> <li>• Ezy Trigonometry</li> <li>• Ezy Graph</li> <li>• GoChart</li> <li>• 3D Geometry</li> <li>• GeoGebra</li> <li>• Khan Academy</li> <li>• Tower of Hanoi</li> </ul>	iTunes store
17-21	<p>Constructing GeoGebra Applets</p> <ul style="list-style-type: none"> <li>• Constructing a Straight Line Graph Applet</li> <li>• Constructing a Quadratic Graph Applet</li> <li>• Constructing a Scalar Product Applet</li> <li>• Student constructed Applets</li> </ul>	[7]
<b>UNIT III. GRAPHING CALCULATORS</b>		
22-25	<p>Common Core aligned activities with Graphing Calculators. The activities may include:</p> <ul style="list-style-type: none"> <li>• Spreading Doom: Modeling the spread of the 2004 Mydoom virus</li> <li>• Creating Boxes: Maximizing volume</li> <li>• Intersecting the Solution: Solving systems of equations graphically</li> <li>• The Pythagorean Theorem</li> <li>• Ratios of Similar Figures</li> <li>• Dilations with Matrices</li> </ul>	[5]
<b>STUDENT LESSONS AND EXAM</b>		
26-28	Student lessons/presentations	
29-30	Review and final exam	

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