

Advanced Integrated Mathematics and Science for Teachers Spring 2010

MATH 619, Section 301

or

SCI 619, Section 301

This course is cross listed. This allows students to take it for mathematics or science credit.

Instructors:

	Dr. Robert Boram	Dr. Karen Lafferty	Dr. Michael Dobranski
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Virtual Office Hours	Monday 5-6 PM Wednesday 10:30-11:30 AM Wednesday 6-7:30 PM	Monday 7-8 PM Tuesday 3-4 PM Thursday 3-4 PM	Wimba Classroom™ Monday 8:00PM - 9:00PM Wednesday 8:00PM - 9:00PM

Textbook:

There will be no required textbook for the course. Most materials for the course will be provided by the instructors on Blackboard™, under Course Documents. The URL to access the course materials is <http://moreheadstate.blackboard.com/>.

Course Expectations:

It is expected that each student will have dependable Internet access. Every week, new online course materials and assignments will be added to Blackboard™. Announcements will be posted whenever new material becomes available. One week after the completion of a project (module), the materials will be removed from Blackboard™. Late work will be assessed a 10% penalty. Revisions of assessed work may be submitted within one week of when it has been returned.

It is expected that each student will participate in the class discussion at least three times each week. The topic for discussion will be posted each week. You may address comments to the faculty and/or fellows students. Any questions relating to the course material, how to do things, or other course related concerns should be posted to the Discussion Board at the course Blackboard™ site.

It is expected that each student will attend at least one of the 1-hour online conferences each week. We will be using Wimba Classroom™. You may access Wimba Classroom™ through Blackboard™, under Communications. Online conferences are scheduled for Mondays and Wednesdays, 08:00PM – 09:00PM.

It is expected that you will have access to spreadsheet software, word processing software, PowerPoint software, and a TI-83 Plus or TI-84 Plus graphing calculator. If you are unable to access a TI-83 Plus or TI-84 Plus graphing calculator, please contact Dr. Boram or Dr. Dobranski.

Occasionally Blackboard will be unavailable due to technical problems. When this happens, hang in there and complete the work as soon as it is up and running again. If this continues for more than a week, we will work with you. If you are having problems accessing Blackboard, please call the MSU Blackboard help desk at 866-590-9239.

Each of the faculty will evaluate a portion of the submitted materials. The science portions will be evaluated by Dr. Boram, the mathematics portions will be evaluated by Dr. Dobranski, and the education portions will be evaluated by Dr. Lafferty.

Guidelines for completing each assignment will be provided on Blackboard and the grades for completed work will be posted on Blackboard.

Morehead State University goals of general education:

Students will be expected to demonstrate the ability to

- A. Communicate accurately and effectively;
- B. Locate, select, organize and present information efficiently;
- C. Think and reason analytically;
- E. Function responsibly in the natural, social, and technological environment;
- F. Recognize and respond to aesthetic values in creative human expression found in mathematics and science; and
- G. Develop life skills.

Standards addressed in this course:

Kentucky Teacher Standards (February 2008)

- Standard 1: The teacher demonstrates applied content knowledge
- Standard 2: The teacher designs and plans instruction
- Standard 5: The teacher assesses and communicates learning results
- Standard 6: The teacher demonstrates the implementation of technology
- Standard 7: The teacher reflects on and evaluates teaching and learning
- Standard 8: Collaborates with colleagues/parents/others

NCATE/ NCTM Program Standards (2003)

- Standard 1: Knowledge of Mathematical Problem Solving
- Standard 2: Knowledge of Reasoning and Proof
- Standard 3: Knowledge of Mathematical Communication
- Standard 4: Knowledge of Mathematical Connections
- Standard 5: Knowledge of Mathematical Representation
- Standard 6: Knowledge of Technology

- Standard 7: Dispositions
- Standard 10: Knowledge of Different Perspectives on Algebra
- Standard 11: Knowledge of Geometries
- Standard 14: Knowledge of Data Analysis, Statistics, and Probability

The NCATE program standards for science as developed by NSTA.

This course will address the following standards:

- Standard 1 Content: Content refers to concepts and principles understood through science; concepts and relationships unifying science domains; processes of investigation in a science discipline; and applications of mathematics in science research.
- Standard 2 Nature of Science: Nature of science refers to characteristics distinguishing science from other ways of knowing; characteristics distinguishing basic science; applied science, and technology; processes and conventions of science as a professional activity; and standards defining acceptable evidence and scientific explanation.
- Standard 3 Inquiry: Inquiry refers to questioning and formulating solvable problems; reflecting on, and constructing, knowledge from data; collaborating and exchanging information while seeking solutions; and developing concepts and relationships from empirical experience.
- Standard 4 Context of Science: The context of science refers to relationships among systems of human endeavor including science and technology; relationships among scientific, technological, personal, social and cultural values; and the relevance and importance of science to the personal lives of students.
- Standard 5 Skills of Teaching: Skills of teaching refers to science teaching actions, strategies and methodologies; interactions with students that promote learning and achievement; effective organization of classroom experience; use of advanced technology to extend and enhance learning; and the use of prior conceptions and student interests to promote new learning.
- Standard 8 Assessment: Assessment refers to the alignment of goals, instruction and outcomes; measurement and evaluation of student learning in a variety of directions and the use of outcome data to guide and change instruction.

Purpose of the course:

This is a course which will integrate mathematics and science for in-service elementary, middle school and high school teachers of mathematics and science. This course is designed to provide in-service teachers with experience analyzing and interpreting real world data. The course is designed to strengthen content knowledge as well as exposing teachers to pedagogical strategies, materials, and activities that they will be able to implement in their classrooms.

The course is designed to deal with specific problems and issues that require the use of multiple areas of the National Science Education Standards and multiple areas of the

Principles and Standards for School Mathematics. Four projects have been chosen that will use web data and resources. These projects are varied enough so that there will be little overlap in mathematics and/or science content.

Outline of course content:

Students will complete projects on the following topics:

Climate Project: Students will work through an introductory set of climate data to develop a mathematical model. After developing an intuitive understanding of the science underlying the mathematical models, the students will analyze world wide web climate data from several locations around the world to determine the mathematical functions that can best describe the climate fluctuations at any given location. Finally, students will be given climate data from an unknown location and must determine its approximate location based on a mathematical analysis of the data.

Ozone Depletion Project: Using mathematical principles and science concepts the students will access and analyze global ozone levels. The trends over time for global location will be analyzed using appropriate technology. The featured concepts are graphing, eigenregion analysis, UV radiation effects, time-rate analysis, and trend analysis.

Moon and Venus Phase Project: Using geometry principles and scientific observations the students will collect, access and analyze data dealing with the phases of the moon and the phases of Venus. The featured concepts are planar geometry, trigonometry, three-body problems, reflection and light intensity.

Schedule:

Week	Projects and Goals	Work Due During Week
1	Introduction to the “Nature of Science” and “Mathematical Modeling”	Pre-Course Survey; Nature of Science Reading Quiz; Mathematical Modeling Quiz; Survey of Technology Resources; Weekly Discussion Board
2	Introductory Mathematical Modeling Exercise	Mathematical Model Write-up; PBL Reading Reflection; Weekly Discussion Board
3	Introduction to GLOBE data and climate models; Development of climate models for pre-project class data	Climate Reading Quiz; Introductory GLOBE data set; Weekly Discussion Board
4	Assessment of geographical info for data site location; Collection of individual GLOBE data set and refining the data for analysis	Submit model for the pre-project class data; Geographical data assessment; Weekly Discussion Board

5	Development models for the assigned GLOBE data sets and begin preparation of PowerPoint presentation; Interpretation of the models	Begin development of power point presentation; Submit model for assigned location; Weekly Discussion Board
6	Share models and underlying science with other individuals	Complete power point presentation incorporating all class models; Classroom Connections Project 1; Weekly Discussion Board
7	Introduction to TOMS data, ozone theories, and global warming	Ozone Reading Quiz; Introductory TOMS data; Weekly Discussion Board
8	Development of ozone models for pre-project class data. Introduction to ozone theories; Collection of individual TOMS data set, development of models, research additional ozone and atmospheric sciences materials	Submit model for the pre-project class data; Geographical data assessment; Ozone data collection and analysis; Develop mathematical model for assigned ozone data; Begin development of ozone report; Weekly Discussion Board
9	Share models with other groups/individuals	Ozone module assessed. Classroom Connections Project 2 Weekly Discussion Board
10	Complete ozone report, incorporating all class models	Complete ozone report development, incorporating all class models; Weekly Discussion Board
11	Introduction to moon data, periodic phenomenon, and planetary sciences. Introduction to planetary theories	Moon/Planet Phases Reading Quiz; Process moon phase data; Planetary sciences researched; Development math models for the moon phases.
12	Development of moon planetary system geometric models for pre-project class data.	Moon planetary system geometric models. Weekly Discussion Board
13	Access Venus data set and analyze data. Development of models for the Venus phase data.	Data collection and analysis for Venus data. Begin development of poster. Classroom Connections Project 3 Weekly Discussion Board
14	Prepare posters for moon and Venus phase module	Complete poster development. Planetary science module assessed.

		Classroom Connections Project 4 Outline. Weekly Discussion Board
15	Begin final exam unit plan	Weekly Discussion Board
16	Total course assessment, self-evaluation, final exam week.	Submit final exam. Classroom Connections Project 4

Assessment:

The Principles and Standards for School Mathematics developed by the National Council of Teachers of Mathematics and the National Science Education Standards developed by the National Research Council are the basis for the assessment for each of the four projects. These Standards will be imbedded in a pre and post assessment for each of these projects to be completed during the course. Each project will have alternative assessment(s), that may include: portfolio, performance task, research paper, web page, oral presentation materials (e.g., power point or poster presentation), and/or student self-assessment. Various assessment tools may be used in pre and post assessment.

Climate Project: The pre-assessment and post-assessment will include performance tasks (e.g., given climate data from an unknown location, determine location from a mathematical analysis of the data.) The pre-project will be to study and model the annual climate for some location of the globe. The alternative assessment will be the creation of a power point presentation. The power point presentation will include data graphs, modeling equations, and geographic connections to model parameters.

Readings and Learning Activities = 10% of the final grade
Power Point Presentation = 10% of the final grade

Ozone Depletion Project: The pre-assessment and post-assessment will include performance tasks. The pre-project will be to study and model the ozone depletion for the latitude band of 10 to 30 degrees north. The alternative assessment will be the creation of a web page. The web page will consist of graphing, eigenregion analysis, UV radiation effects, time-rate analysis, and trend analysis.

Readings and Learning Activities = 10% of the final grade
Web-page = 10% of the final grade

Moon and Venus Phase Project: The pre-assessment and post-assessment will include performance tasks. The pre-project will be to study and model the phases of the moon using geometry. The alternative assessment will be the creation of a poster presentation. The poster presentation will present the phases of the moon and Venus where the students are given Venus data and determine geometric models for the phases of Venus. Topics addressed on the poster will also include planar geometry, three-bodied problems, reflection and light intensity.

Readings and Learning Activities = 10% of the final grade
Poster presentation = 10% of the final grade

Final Exam Project = 10% of the final grade
Introductory Tasks= 10% of the final grade

Overall course grading scale:

A = 92 to 100%

B = 84 to 91.9%

C = 76 to 83.9%

D = 68 to 75.9%

E = Below 68%

The final grade is based on the cumulative total for all the work required in the class.

Americans with Disabilities Act (ADA): In compliance with the ADA, all students with a documented disability are entitled to reasonable accommodations and services to support their academic success and safety. Though a request for services may be made at any time, services are best applied when they are requested at or before the start of the semester. To receive accommodations and services the student should immediately contact the Disability Services Coordinator in the Office of Academic and Career Services, 223 Allie Young Hall, 606-783-5188, www.moreheadstate.edu/acs/.