

# UMBC UGC New Course Request: EDUC435 - Integrated STEM Content and Pedagogy

Date Submitted: 2/16/2016

Proposed Effective Date: 8/1/2017

	Name	Email	Phone	Dept
Dept Chair or UPD	Eugene Schaffer	geneschaffer@gmail.com	x52466	Education
Other Contact	Tracy Irish	tirish1@umbc.edu	x53050	Education

## COURSE INFORMATION:

Course Number(s)	EDUC435
Formal Title	Integrated STEM Content and Pedagogy
Transcript Title (≤30c)	Intg STEM Content and Pedagogy
Recommended Course Preparation	None
Prerequisite <b>NOTE:</b> Unless otherwise indicated, a prerequisite is assumed to be passed with a "D" or better.	N/A
Credits	3
Repeatable?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Max. Total Credits	3 <small>This should be equal to the number of credits for courses that cannot be repeated for credit. For courses that may be repeated for credit, enter the maximum total number of credits a student can receive from this course. E.g., enter 6 credits for a 3 credit course that may be taken a second time for credit, but not for a third time. Please note that this does NOT refer to how many times a class may be retaken for a higher grade.</small>
Grading Method(s)	<input checked="" type="checkbox"/> Reg (A-F) <input type="checkbox"/> Audit <input type="checkbox"/> Pass-Fail

## PROPOSED CATALOG DESCRIPTION (no longer than 75 words):

Students will review the integrated approaches to teaching Science, Technology, Engineering, and Mathematics (STEM). Integrated STEM pedagogies include project/problem-based (PBL), design-based, and inquiry-based approaches to teaching.

## RATIONALE FOR NEW COURSE:

The Maryland State Department of Education (MSDE) has added middle school (grades 4-9) to its areas of teacher certification. In order to be competitive within the State and serve the UMBC students who want to specialize in STEM education at the middle school level, the education department is proposing a new Middle School STEM Education degree. In order to meet rigorous standards for middle grades teachers established by the Association for Middle Level Education, EDUC435 - Integrated STEM Content and Pedagogy, will be offered annually as an upper level course taken to prepare students for the 100-day internship required for Maryland teaching certification.

Middle level teacher preparation programs are expected to prepare candidates to "demonstrate their ability to assist all young adolescents in understanding the interdisciplinary nature of knowledge" (AMLE, Standard #2). EDUC 435 will help students to meet this standard by providing them with a conceptual understanding of the interdisciplinary nature of knowledge in the STEM fields.

**ATTACH COURSE OUTLINE (mandatory):** (See attached)

**Department of Education  
University of Maryland Baltimore County  
EDUC 435  
Integrated STEM Content and Pedagogy**

***THE UMBC DEPARTMENT OF EDUCATION MISSION is to research teaching and learning, and to develop caring, thoughtful, knowledgeable, and skilled teachers who are responsive to children, families and the community. We expect our graduates to be leaders in their schools as well as advocates for democracy and social justice.***

Tracy Irish  
Room 209, ACIV-A  
Office: 410 455-3050

Office hours: By appt.  
Email: tirish1@umbc.edu

This course provides students with a conceptual understanding of the fields within STEM and the careers within the STEM arena. The students will develop an understanding of the similarities and differences between the individual fields in terms of the nature and scope of the work and requirements. The students will review the integrated approaches to teaching Science, Technology, Engineering, and Mathematics (STEM). Integrated STEM pedagogies include project/problem-based (PBL), design-based, and inquiry-based approaches to teaching. Students in this course will review the standards and critique curriculum in middle grades across the STEM disciplines and gain an understanding of the premise behind STEM education and its link to real world applications to better prepare middle grades students in the 21<sup>st</sup> century.

Next Generation Science Standards, Principles and Standards for School Mathematics, International Technology Education Association Standards and the Maryland State Department of Education STEM Standards of Practice are all introduced and reviewed in this course.

**Association for Middle Level Education Standards (AMLE)**

This course directly addresses the following standards:

**PRINCIPLE B: CONTENT**

**Standard 2: Middle Level Curriculum**

Middle level teacher candidates understand and use the central concepts, standards, research, and structures of content to plan and implement curriculum that develops all young adolescents' competence in subject matter. They use their knowledge and available resources to design, implement, and evaluate challenging, developmentally responsive curriculum that results in meaningful learning outcomes. Middle level teacher candidates demonstrate their ability to assist all young adolescents in understanding the interdisciplinary nature of knowledge. They design and teach curriculum that is

responsive to all young adolescents' local, national, and international histories, language/dialects, and individual identities (e.g., race, ethnicity, culture, age, appearance, ability, sexual orientation, socioeconomic status, family composition).

Element a. Subject Matter Content Knowledge: Middle level teacher candidates demonstrate a depth and breadth of subject matter content knowledge in the subjects they teach (e.g., English/language arts, mathematics, reading, social studies, health, physical education, and family and consumer science). They incorporate information literacy skills and state-of-the-art technologies into teaching their subjects.

Element b. Middle Level Student Standards: Middle level teacher candidates use their knowledge of local, state, national, and common core standards to frame their teaching. They draw on their knowledge of these standards to design, implement, and evaluate developmentally responsive, meaningful, and challenging curriculum for all young adolescents.

Element c. Interdisciplinary Nature of Knowledge: Middle level teacher candidates demonstrate the interdisciplinary nature of knowledge by helping all young adolescents make connections among subject areas. They facilitate relationships among content, ideas, interests, and experiences by developing and implementing relevant, challenging, integrative, and exploratory curriculum. They provide learning opportunities that enhance information literacy (e.g., critical thinking, problem solving, evaluation of information gained) in their specialty fields (e.g., mathematics, social studies, health).

## **Course Objectives and Outcomes**

This course

During this course, you will:

- become familiar with STEM and STEM education and the corresponding standards for middle grades teaching and learning
- Consider the careers that are STEM focused and what the middle grades students need to know and be able to do in those careers
- develop a deep understanding of the nature of science, technology, engineering, and mathematics and they are similar and different. How the nature of STEM reflects real world problems and solutions
- gain experience in various types of learning and assessments through the course assignments and in reviewing middle grades curriculum

## **Course Reading Material/BlackBoard**

There is no textbook for this course. Course readings can be found in Blackboard, course documents.

All readings will be posted on BB and you will be expected to access it frequently to post your own assignments and to post and read your classmates in the discussion board section.

### **Overarching principles of the Course**

- This class is a community. To make it work, we ALL must be prepared and ready to participate every time we meet.
- Teachers need to learn to manage time both in and out of class. Therefore, you will be expected to hold to time constraints when presenting or contributing in class.
- Teachers are expected to be in school nearly every day and to be on time. Therefore, one excused absence is allowed under normal circumstances. After that, each absence will lower your grade, as will excessive lateness or leaving early.

### **Academic Integrity**

By enrolling in this course, each student assumes the responsibility of an active participant in UMBC's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty and they are wrong. Academic misconduct could result in disciplinary action that may include suspension or dismissal.

### **Classroom Accommodations for Students with Disabilities**

If you are a student with a documented disability who requires an academic adjustment, auxiliary aids, or similar accommodations, please contact the Office of Student Support Services at 410-455-3250.

### **Course Requirements and Grading**

The following assignments in this course has the following point distribution:

<u>Assignment Description</u>	<u>Point Value</u>
Technical Paper on STEM Careers and Skills	20 points
Argument Paper on Nature of STEM	30 points
Research Paper on Issues in STEM Education	30 points
Concept Mapping on STEM teaching and learning	25 points
Critique of STEM Lesson plan	30 points
Reflection Paper on Implementation of STEM Education	15 points
Total Points	150 points

**Class Schedule**

	<b>In-class discussion and activities</b>	<b>Readings (To be discussed in class)</b>
<b>Week 1</b>	What is STEM? What is the S – T – E – M? How is STEM different than the individual components?	Overview of Course Syllabus and assignments  STEM Integration in K-12 Education: Status, Prospects, and an Agenda for Research Chapter 1 Introduction to STEM and STEM Education
<b>Week 2</b>	What is science? What is the nature of science? How do scientists do science? What are the K-12 standards?	Teaching the nature of Science through process skills activities for grades 3-8 Chapter 1 What is Science
<b>Week 3</b>	What is engineering? What is the nature of engineering? How do engineers do engineering? What are the K-12 standards?	Engineering in K-12 Education: Understanding the Status and Improving the Prospects Chapter 2 What is Engineering
<b>Week 4</b>	What is mathematics? What is the nature of mathematics? How do mathematicians do math? What are the K-12 standards?	Concepts of Modern Mathematics Chapter 1 Mathematics in General
<b>Week 5</b>	What is technology? What is the nature of technology? How do technologists do technology? What are the K-12 standards?	Technology Education: Learning by Design – Middle Grades Unit 1 The Nature of Technology
<b>Week 6</b>	What are the careers in STEM? What real world applications and careers are in Middle Grades curriculum? Why does it matter?	
<b>Week 7</b>	What are the similarities and differences of science and engineering? Why does it	STEM lesson essentials, grades 3-8: Integrating Science, Technology, Engineering, and Mathematics Chapters

	matter?	1&2 Integrating Engineering + Science in your classroom Chapters 1 & 2
<b>Week 8</b>	What is STEM education? Why STEM education? What are the K-12 standards?	STEM lesson essentials, grades 3-8: Integrating Science, Technology, Engineering, and Mathematics Chapter 3

<b>Week 9</b>	What are the 21 <sup>st</sup> Century Learning Skills? What are the MSDE STEM Standards of Practice? How do the standards come together?	Handouts Next generation Science Standards for States, by States: Volume 1: The Standards-arranged by disciplinary core ideas and by topics Introduction and various middle grades standards
<b>Week 10</b>	How do we do STEM education? How were you taught in K-12 schools? What do you know about adolescents and how they learn?	Successful K-12 STEM Education: Identifying Effective Approaches in Science, Technology, Engineering, and Mathematics Chapters 1 & 2 Integrating Engineering + Science in your classroom Chapter 2
<b>Week 11</b>	What is inquiry-based teaching? What are levels of inquiry-based teaching and learning?	STEM lesson essentials, grades 3-8: Integrating Science, Technology, Engineering, and Mathematics Chapter 6
<b>Week 12</b>	What is project-based learning? How is it different?	STEM Integration in K-12 Education: Status, Prospects, and an Agenda for Research Chapters 2 -4 Article: Seven Essentials for Project-Based Learning Educational Leadership 2010

<b>Week 13</b>	Challenge-Based teaching and learning – how is it different from PBLs?	Article: Challenge Based Learning A Classroom guide 2011
<b>Week 14</b>	What is reflective teaching? Facilitator as teacher?	STEM lesson essentials, grades 3-8: Integrating Science, Technology, Engineering, and Mathematics Chapter 14
<b>Week 15</b>	Bringing it all together	

### **References of Course Materials:**

Bell, R. L. (2008). *Teaching the nature of Science through process skills activities for grades 3-8*. New York, NY: Pearson Education.

Brunsell, E. (ed.). (2012). *Integrating Engineering + Science in your classroom*. Arlington, VA: ASTA Press.

Enderle, P. J., Bickel, R., Gleim, L., Granger, E., Grooms, J., Hester, M., ... Southerland, S. A. (2015). *Argument-driven inquiry in life science: Lab investigations for grades 6-8*. Arlington, VA: ASTA Press.

Hacker, M. & Burghardt, D. (2004). *Technology Education: Learning by Design –Middle Grades*. Pearson Publishing.

NGSS Lead States. (2013). *Next generation Science Standards for States, by States: Volume 1: The Standards-arranged by disciplinary core ideas and by topics*. Washington, DC: The National Academies Press.

NGSS Lead States. (2013). *Next generation Science Standards for States, by States: Volume 2: Appendixes*. Washington, DC: The National Academies Press.

Steward, I. (2015) *Concepts of Modern Mathematics*. Dover Publications.

Vasquez, J. A., Sneider, C. & Comer, M. (2013). *STEM lesson essentials, grades 3-8: Integrating Science, Technology, Engineering, and Mathematics*. Portsmouth, NH: Heinemann.

Zorfass, J. M. & Copel, H. (1998). *Teaching middle school students to be active researchers*. Alexandria, VA: ASCD.