University of Arkansas, College of Education and Health Professions
Department of Curriculum and Instruction

1. Program Affiliation: Career and Technical Education: Technology and Engineering Education

1.1 Course Number and Title: TEED 4103: Engineering Design for Technology Education: Capstone

Prerequisites: TEED 1103, TEED 3103 (or STEM 4033)

1.2 Instructor:
Vinson Carter, Ph.D.
314 Peabody Hall
vcarter@uark.edu
575-3076

1.3 Research Base:

Eide, A., Jenison, R., & Northup, L. (2002). *Introduction to engineering design and problem solving* (2nd ed.) Boston, MA: McGraw-Hill. (ISBN 0072402210).

International Technology Education Association. (2000). *Standards for technological literacy: Content for the study of technology*. Reston, VA: Author.

2. Course Description/Justification

2.1 Catalog Description: Analysis of engineering design, focus on design processes, physical and computer modeling, & materials processing.

2.2 Relationship to Knowledge Base: This course supports the Scholar- Practitioner model as a pedagogical knowledge and skills course. The Capstone experience is typically completed by senior students within the major and is designed to elicit opportunities for educational reflection and synthesis of knowledge and skills as well as preparation for student teaching.

3. Goals and Objectives

3.1 Goals

This capstone course supports the "Specialty Studies" component of the Scholar-Practitioner model by providing the technology teacher education candidate with a capstone experience related to technology education and engineering design. The course will model the methods expected in a contemporary technology education facility and expose the candidate to instructional strategies expected of exemplary programs in the field.

All candidates pursuing degrees in the College of Education and Health Professions are expected to apply the principles of the conceptual framework as *Scholar Practitioners.* The scholar practitioner reflects a professional who is knowledgeable about subject matter and pedagogy; skillful in teaching and managing classrooms and schools; caring about students, families, school staff and the community; and constantly inquiring to better the profession and increase the success of students, schools and the community.

The scholar practitioner is **knowledgeable, skillful, caring and inquiring** and is defined by the following tenets:

1. One who accesses, uses, or generates knowledge
2. One who plans, implements, and models best practices
3. One who understands, respects, and values diversity
4. One who is a developing professional and a lifelong learner
5. One who communicates, cooperates, and collaborates with others
6. One who makes decisions based upon ethical standards and professional criteria
7. One who is knowledgeable about teachers and teaching, learners and learning, and schools and schooling

Technology: As with all teacher preparation coursework, students are expected to demonstrate technological competence in this course. This technological competence will be demonstrated through the use of the appropriate technological hardware and software as well as other web-based applications. Scholar-practitioners will utilize technology that enhances the instructional process during the completion on this course.

3.2. Objectives

Upon the completion of this course, students will be able to:

3.2.1. Describe the history and significant social, cultural, and political events that have shaped the fields of engineering and design;

3.2.2. Describe the history and significant social, cultural, and political events that have shaped the fields of engineering and design;

3.2.3. Describe and be conversant with the role that technological design has on societal evolution;

3.2.4. Utilize the principles and elements of engineering and design to solve advanced design problems;

3.2.5. Compare and contrast between differing engineering and design problem solving models;

3.2.6. Demonstrate the ability to utilize knowledge technology, engineering and design to develop engaging curriculum for secondary students;

3.2.7. Demonstrate the ability to solve advanced simulations that result in computer generated models of technological products or systems;

3.2.8. Demonstrate the ability to solve advanced simulations that result in computer generated models of technological products or systems;

3.2.9. Analyze the traits of a fully functional engineering or design studio at the secondary level;

3.2.10. Clearly describe the safety issues and procedures for tools and equipment in a fully functional secondary school site;

3.2.11. Clearly describe the procedures for maintaining the tools, equipment and materials in a fully functional secondary school site;

3.2.12. Demonstrate the ability to develop and teach engineering and design-based curriculum materials secondary students, and,

3.2.12. Demonstrate the ability to develop a secondary program of study that is reflective of the state and national standards for technology education.

4. Student Activities and Experiences

4.1. Assignments/Tasks

Grades for each student will be based on the following assignments:

4.1.1. Daily and weekly assignments (25 points)
Candidates are expected to attend all classes and participate in ongoing activities, assignments, readings, and discussion. Candidates are required to maintain professional decorum during class.

4.1.2. Product Development (50 points)
Throughout the semester, candidates will use tools, techniques, and materials to design and develop a product or device within established constraints.

4.1.4. Technology and Engineering Education Collegiate Association (TEECA) and the Razorback Technology Challenge (25 points)
Candidates will help prepare for and facilitate the 2015 Razorback Technology Challenge at the U of A and the Midwest TEECA competitions.

5. Content Outline

5.1. The engineering and design professions

a. A brief history of design and engineering
b. Design and engineering solutions

5.2. Engineering design – A process

a. Foundational skills & mental models
b. Need identification and problem definition

5.3. The design problem solving process

a. Problem definition
b. Concept generation
c. Concept selection/judgment
d. Solution implementation
e. Solution testing

5.4. Representation of technical Information

a. Visualization

b. Mental models
c. Mental blocks
d. Modeling and simulation

5.5 Design ideation and documentation

a. Materials selection and materials in design
b. Materials processing and design
c. Communication procedures

5.6 Development processes and organizational structures

a. Product planning
b. Product specifications & constraints

5.7 Managing the engineering design laboratory

a. The learning environment
b. Tool procurement and management
c. Laboratory layout and design
d. Human subjects management

5.8 Applying engineering and design in the classroom

a. Teaching methods
b. Curriculum development
c. Assessment techniques
d. Resources

6. Evaluation Policies

6.1. The following scale will be used to determine the final grade in the course:

A=100-93; B=92-85; C=84-78; D=77-70; F-below 69.

7. Syllabus Change

The Instructor reserves the right to make changes as necessary to this syllabus. If changes are made, advance notification will be given to the class.

8. Academic Policies

8.1 Accommodations

Students with disabilities requesting reasonable accommodations must first register with the Center for Educational Access. The CEA is located in the Arkansas Union, Room 104, and on the web at http://www.uark.edu/ua/csd/applications.htm. The CEA provides documentation to students with disabilities who must then provide this documentation to their course instructors. Students with disabilities should notify their course instructors of their need for reasonable accommodations in a timely manner to ensure sufficient time to arrange reasonable accommodation implementation and effectiveness. A typical time frame for arranging reasonable accommodations for students who are registered with the CEA is approximately one to two weeks.

8.2 Academic Integrity

The application of the University of Arkansas Academic Integrity Policy will be fully adhered to in this course. Grades and degrees earned by dishonest means devalue those earned by all students; therefore, it is important that students are aware of the University of Arkansas Academic Integrity Policy. Academic dishonesty involves acts, which may subvert or compromise the integrity of the educational process.

"As a core part of its mission, the University of Arkansas provides students with the opportunity to further their educational goals though programs of student and research in an environment that promotes freedom of inquiry and academic responsibility. Accomplishing this mission is only possible when intellectual honesty and individual integrity prevail."

"Each University of Arkansas student is required to be familiar with and abide by the university's Academic Integrity Policy' which may be found one the UA website. Students with questions about how these policies apply to a particular course or assignment should immediately contact their instructor." The description of the Academic Integrity Policy is located at: http://provost.uark.edu/245.php

The Academic Integrity Sanction Rubric is located at: http://provost.uark.edu/246.php

All students are to complete their own work during the semester. Although students are allowed to share ideas and learn from one another throughout the semester, students are not allowed to copy another person's work. All assignments must be original and completed individually. All citations must be documented using the 6th edition of the APA manual (http://www.apastyle.org/, http://psychology.vanguard.edu/faculty/douglas-degelman/apa-style/)

8.3 Inclement Weather

For information regarding whether the university is closed or an inclement weather day is declared, use the following sources:

- See the inclement weather web site at: http://emergency.uark.edu/17098.php
- Call 479-575-7000 or 575-2000 for recorded announcements about closings.
- Listen to KUAF Radio, 91.3 FM, or other local radio and television stations Check your e-mail.

8.4 Instructor Policies

Attendance

This course is reserved for candidates preparing to become professional teachers. Subsequently, the ethics and responsibilities of professional teachers will be expected of all participants. Candidates must attend class to receive the maximum benefit and to avoid leaving their professional responsibilities in the hands of classmates. Candidates will be allowed two "sick" days regardless if excused or unexcused, if needed. Additional absences will result in the lowering of one letter grade per absence in your final grade. Furthermore, two occasions of coming late to class or leaving early will be counted as one absence.

Candidates are expected to arrive early, stay focused and attentive during the class, and submit all required materials prior to the due date. Late work will not be accepted for full-credit.

Professionalism

All candidates are to complete their own work during the semester. Although candidates are allowed to share ideas and learn from one another throughout the semester, students are not allowed to copy another person's work. All assignments must be original and completed individually. All citations must be documented using the 6th edition of the APA manual (http://www.apastyle.org/, http://psychology.vanguard.edu/faculty/douglas-degelman/apa-style/)

Candidates are required to maintain professional decorum during class. Cell phones and other electronic devices must be turned off and out of sight during class. Inappropriate and disruptive classroom behavior (including the use of cell phones, iPads, laptops, and other electronic devices) will not be tolerated, and may result in the loss of points from daily and weekly assignments.