University of Arkansas, College of Education and Health Professions
REHABILITATION, HUMAN RESOURCES, AND COMMUNICATION DISORDERS

I. Program Affiliation: Vocational Education, Technology Education concentration

Course Number and Title: TEED 3103: Technology Research, Experimentation, and Trouble-shooting

Catalog Description: Foundational concepts of engineering & design including analysis and use of technology problem solving tools of research, experimentation and trouble-shooting.

Prerequisite: TEED 1103

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II. Relationship to knowledge Base:

This course supports the "Specialty Studies" component of the Scholar-Practitioner model by providing the technology teacher education candidate with a set of technological problem solving tools that can be used to develop curriculum, deliver instruction, and guide learning in the field. The course will model the methods expected in a contemporary technology education facility and expose the candidate to instructional strategies utilized throughout exemplary programs in the field.

III. Goals:

This course is designed to provide knowledge and methods for solving technological problems and teaching engineering design. Elements of design and theory will be applied through design problems, research problems, experimentation, and trouble-shooting activities. Software, design, and problem solving techniques from the fields of science, engineering, and technology will be utilized.

IV. Competencies:

Upon successful completion of this course, students will demonstrate knowledge, skills and competencies in the following areas:

1. Understand the historical background and development of the fields of design and engineering (SP 1) (PW: A, B);

2. Describe the goals, objectives and organization of the Standards for Technological Literacy (National Standards) (SP 1, 6, 7) (PW: A, B);

3. Apply technical tools and resources toward solving human and environmental problems (SP 1, 2) (PW: A, B);

4. Apply quantitative models and tools toward solving human and environmental problems (SP 2, 3, 6) (PW: A, B);

5. Develop confidence in the use and development of design models and engineering constraints (SP 2, 7) (PW: A, B);

6. Develop the ability to work in collaborative design teams to meet given criteria and solve engineering-related problems (SP 5) (PW: A, B);

7. Utilize the fundamentals of design and engineering in the development and delivery of curriculum (SP 7) (PW: A, B);

8. Utilize the vocabulary, primary concepts, definitions, and models applicable to engineering and design (SP 1) (PW: A, B);

9. Demonstrate the ability to communicate engineering and design concepts with colleagues and students using oral, written, artifact-based, and graphic channels of communication (SP 5, 7) (PW: A, B, D);

10. Develop innovative and alternative teaching methods and learning activities that promote the teaching of engineering, design and the national standards for technology (SP 4, 5, 7) (PW: A, B); and,

11. Develop and deliver curriculum units of instruction related to the content of this course while paying special attention to standards, behavioral or performance objectives, lesson content, teaching strategies, lesson activities, diversity, and assessment strategies (SP 3, 5, 7) (PW: A, B, C, D).

V. Content:

1. Introduction to engineering and design (PW: A, B, D)

a. The history of design
b. The history of the engineering profession
c. The vocabulary of engineering and design
d. Engineering & design as a tool for teaching technology
e. The relationship between adjoining disciplines (technology education/engineering)

2. The Standards for Technological Literacy (PW: A, B, D)

a. The role of the standards
b. The relationship between the standards and engineering
c. Delivering the standards through engineering and design
d. Using standards to develop curriculum

3. Solving human and environmental problems (PW: A, B)

a. Surviving nature
b. A search for a more comfortable life
c. Technology solving and creating problems
d. Unexpected results/unintended consequences

4. **Fundamentals of engineering and design (PW: A, B)**
    a. Foundational concepts
    b. Form, function, balance, texture, etc.
    c. Computer and quantitative modeling
    d. Adhering to design parameters and constraints
    e. Risk/benefit analysis
    f. Technological assessment

5. **Tools of engineering and design (PW: A, B)**
    a. Questioning/clarifying the problem
    b. Identifying constraints/limitations
    c. Gathering research
    d. Quantifying/mental modeling
    e. Visioning and graphic representation
    f. Drawing and modeling (including software usage)
    g. Prototyping and assessment
    h. Artifact development
    i. Communicating the results of engineering/design

6. **Fundamental techniques (PW: A, B)**
    a. Engineering design (innovation)
    b. Experimentation
    c. Research and development
    d. Troubleshooting
    e. Invention

7. **Teaching with engineering and design (PW: A, B, C, D)**
    a. Teaching with the end in mind
    b. The role of design and engineering in the secondary classroom
    c. Curricular assessment procedures, tools, and techniques
    d. Developing curriculum and activities
    e. Instructional methods for teaching engineering and design
    f. Collaboration strategies

8. **Course practicum (PW: A, B, C, D)**
    a. Practicum experience
    b. Teaching technological understanding with engineering and design tools

VI. Evaluation:

Learning assessments (portfolio, assignments, and exams/quizzes) are designed to prepare the student to deliver engineering and design content in the secondary classroom. These assessments will also serve as foundational preparation for subsequent methodology and curriculum development activities that will occur in teacher professional development courses in the program. Assessment rubrics and additional assignment details will be provided in the course.

1. **Student Design Curriculum Portfolio (PW: A, B, C)**
   Each student will keep a portfolio (submitted electronically) of engineering and design-based curriculum materials developed through the course. This portfolio will be assessed at the completion of the course **(200 points)**.

2. **Course Practicum Experiences (PW: A, B, C, D)**
   Each student will develop and deliver engineering and design-based instructional materials and activities on a given topic. These instructional materials will be constructed and delivered in accordance with guidelines established in the course outline **(200 points)**.

3. **Design Challenges (PW: A, B)**
   Throughout the semester, students will work in design teams to use tools, techniques, and materials to design under constraints. Students will rotate from design team to design team as they work to solve four engineering design challenges during the course of the semester **(400 points/100 each)**.

4. **Examinations (PW: A, B, C, D):** Mid-term Examination **(100 points)**. Final Examination **(100 points)**.

VII. 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.

VIII. Grading Scale

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

Final Percentage	Final Grade
91% - 100%	A
81% - 90%	B
75% - 80%	C
70% - 74%	D
Below 70%	F

IX. Academic Honesty

The application of the University of Arkansas Academic Honesty Policy, as stated in the Student Handbook 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 Honesty Policy. Academic dishonesty involves acts which may subvert or compromise the integrity of the education process.

X. Accommodations

Students with disabilities requesting reasonable accommodations must first register with the Center for Students with Disabilities. The CSD is located in the Arkansas Union, room 104 and on the web at: http://www.uark.edu/ua/csd/applications.htm. The CSD 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 CSD is approximately one to two weeks.

XI. Classroom Behavior

Appropriate classroom behavior is expected of the instructor and all students. Inappropriate and disruptive classroom behavior (inappropriate language and gestures, class disruptions, disrespect to other students or instructor, and other behavior as determined by the instructor) will not be tolerated and will result in possible removal from the class and /or disciplinary action as per the student handbook.

XII. Inclement Weather

In case of inclement weather, students should phone 575-4758 if they are unsure if the class will meet. In addition, information concerning University closings can be obtained by phoning 575-2000 for announcements. University closing announcements are also made on KUAF Radio, 91.3 as well as local radio and television stations. The University's inclement weather site is updated frequently on both UARKINFO and University Online at http://pigtrail.uark.edu/info/weather.nclk.

XIII. Course Resources

In addition to the University library, guest speakers, and journal articles distributed by the professor, the following reference materials will be used extensively:

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

Holtzapple, M., & Reece, W. (2002). *Concepts in engineering* (1st ed.). Boston, MA: McGraw-Hill. (ISBN 0073011770).

IX. Research Base

Required Texts

Dieter, G. (2000). Engineering design: A materials and processing approach (3rd Ed.). Boston, MA: McGraw-Hill. (ISBN 007235058X).

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