AENG 101 INTRODUCTION TO ENGINEERING (G2)  
3 s.h.

CATALOG DESCRIPTION
This course engages learners in using scientific and mathematical reasoning to explore and engage in engineering design, covers the fundamentals of the engineering design process, and exposes students to a wide range of career paths available to engineers, including engineering, applied engineering, and engineering technology areas. In this course, students will follow the creativity-based engineering design process through laboratory-based activities. Students will design and manufacture physical artifacts to meet a specific engineering challenge, and must defend their decisions with scientific and mathematical reasoning. This course focuses on how engineers apply their creativity, resourcefulness, mathematical, scientific and technical knowledge and skills in the creation or refinement of technological products/systems.

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<th>COURSE OBJECTIVES</th>
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<th>PROGRAM OUTCOMES</th>
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<td>Upon successful course completion, students will be able to:</td>
<td>Students' achievement of course objectives will be assessed based on the following*:</td>
<td>Program learning competencies for the AET(M), ARET, &amp; MFET programs:</td>
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| 1. Explore multiple disciplines of engineering and their applications in the ‘real’ world. | | A. Disciplinary Knowledge  
An ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly defined applied engineering activities. |
| 2. Collect and examine information from a variety of sources to determine what is relevant to the problem. | | |
| 3. Use mathematical and scientific concepts and calculations to determine appropriate solutions for fundamental engineering problems. | | |
| 4. Recognize and use scientific, engineering, and technological thinking (e.g. a set of intellectual processes and their results) to model design ideas and conduct laboratory experiments to test design prototypes. | | B. Design  
An ability to design systems, components, or processes for broadly defined applied engineering problems appropriate to program educational objectives. |
<p>| 5. Explain a solution to a real-world problem in mathematical forms based on prioritized criteria and trade-offs that account for a range of constraints such as | | |</p>
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<th><strong>aesthetics, cost, efficiency, environmental impacts, and safety.</strong></th>
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6. **Analyze** the benefits, limitations, and risks associated with resources available (or technologies proposed) to solve design and engineering problems.

7. **Document** the engineering design process by identifying the problem, design requirements, and strategies for solving the problem.

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E. **Written Communication**
An ability to **apply written communication** in both technical and non-technical environments.

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*LA = Lab Experiment/Design Challenge; QU = Quiz; EX = Exam; HW = Homework/Papers.

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**COURSE OUTLINE**

I. History of Engineering
   a. Traditional Engineering Education
      i. Early Education
      ii. ASEE and The Grinter Report
      iii. Industry Needs
      iv. Branches of Engineering
      v. ABET
   b. Industrial Technology
      i. NAIT
   c. Engineering Technology
      i. ABET
      ii. ATMAE
   d. Applied Engineering
      i. ATMAE
   e. U.S. Department of Education
      i. CIP Codes
   f. National Society of Professional Engineers
      i. State Licensure
      ii. Engineering vs. Engineering Technology

II. Engineering Majors
   a. Traditional/Theoretical
      i. Main Branches
         a. Electrical
         b. Mechanical
         c. Civil
         d. Chemical
         e. Industrial
   b. Specialty / Interdisciplinary
      i. Petroleum
      ii. Aeronautical
      iii. Materials
      iv. Manufacturing
      v. Systems
      vi. Robotics
vii. Biomolecular
viii. Etc.
c. Industrial Technology
   i. General
   ii. Management Core
   iii. Technical Concentrations
d. Engineering Technology
e. Applied Engineering
   i. Management Core
   ii. Engineering Concentrations
f. Profile of the Profession
   i. Trends
   ii. Degrees
   iii. Placement
   iv. Salaries
   v. Diversity

III. Success in the Classroom
   a. Attitude
   b. Goals
   c. Study Habits & Preparation
   d. Hands-on Element
   e. Communicate with Your Professors
   f. Learning Styles
   g. Being Well-rounded
      i. Intellectual
      ii. Social
      iii. Physical
      iv. Spiritual
      v. Emotional
   h. Time Management

IV. Problem Solving & Engineering Design
   a. Problem Solving Methods
      i. Analytic
      ii. Creative
   b. Strategies
   c. Brainstorming Techniques
   d. Engineering Design Process
      i. Ask
      ii. Research
      iii. Imagine
      iv. Plan
      v. Create
      vi. Test
      vii. Improve

V. Teamwork
   a. Growth Stages
      i. Forming
      ii. Storming
      iii. Norming
      iv. Performing
      v. Adjourning
   b. Types of Teams
   c. Membership
   d. Decision Making
VI. Ethics
   a. The Nature of Ethics
   b. Normative Ethics
   c. Applied Ethics
   d. Code of Ethics for Engineers
      i. An Engineer’s Obligation to Society
      ii. An Engineer’s Obligation to Employers and Clients
      iii. An Engineer’s Obligation to Other Engineers

VII. Engineering Principles
   a. Mechanical
      i. Simple Machines
         1. Lever
         2. Wheel and Axle
         3. Inclined Plane
         4. Wedge
         5. Screw
         6. Pulley
      ii. Friction, Entropy and System Efficiency
      iii. Material Properties
         1. Chemical
         2. Electrical
         3. Magnetic
         4. Manufacturing
         5. Mechanical
         6. Optical
         7. Thermal
         8. Other
      iv. Fluidics
         1. Pascal’s Law
         2. Boyle’s Law
         3. Charles’ Law
         4. Bernoulli’s Theorem
      v. Hydrodynamics
         1. Terminology
         2. Displacement Hulls
         3. Planning Hulls
         4. Buoyancy / Archimedes Principle
         5. Center of Gravity
         6. Stability
      vi. Trigonometry
      vii. Statics and Strength of Materials
   b. Electronic/Electrical
      i. Magnetism and AC Power
         1. Transformers
         2. Motors
      ii. DC Power
         1. Chemical
         2. Rectified
      iii. Simple Circuits (Series and Parallel)
         1. Ohm’s Law
         2. Kirchhoff’s Laws
         3. Power
         4. Resistors, Switches, and loads
      iv. Digital Gate ICs
         1. Truth Tables
         2. Boolean Algebra
      v. Soldering
c. Programming / Robotic Control
   i. History of the PC and Robotics
   ii. Microcontrollers
   iii. High-Level Language
      1. Variables
      2. Functions
      3. If Statements and Loops
      4. Libraries
      5. Comments
      6. PWM for Servo Motor Control
      7. Sensors
   iv. Flowcharting
   v. Real-time I/O

TEXTS

COURSE REQUIREMENTS
Students are expected to participate in or complete the following activities:

1. Complete and submit all required laboratory experiments.
2. Satisfactorily complete all examinations.
3. Participate and contribute equally toward the completion of a final project and presentation.
4. Participate in all assigned clean-up activities at the end of each class session.
5. Regularly attend all lecture and laboratory sessions in their entirety. An attendance record will be maintained by the instructor during both lecture and laboratory segments. The attendance policy adopted by the Department of Applied Engineering, Safety & Technology will be in effect; unauthorized absences exceeding the number permitted in the departmental policy (3) will result in removal from the course, and a grade of "F" will be assigned. A copy of the departmental policy concerning attendance is included in this syllabus.

EVALUATION
Engineering Investigation Reflection 1-page Synopsis 5%
Engineering Ethics 1-page Synopsis 5%
Design Challenges
   Autonomous Sumobot (Robotics) 15%
   Rube Goldberg Machine (Mechanical Advantage) 15%
   Rubber Duckie Shelter Design (Statics) 15%
   Boat Hull Design (Hydrodynamics) 15%
Exams (2 @ 15% each)* 30%
100%

*Each student is allowed to use a single page (8.5"x11") hand written reference sheet. This sheet must be unique and original to the student – it may not be copied or reduced (size) with a copier. Reference sheets will be inspected by the instructor prior to taking the quiz.

Scale:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Score</th>
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<tr>
<td>A</td>
<td>93 - 100</td>
<td>90 - 92.9</td>
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<tr>
<td>A-</td>
<td>80 - 82.9</td>
<td>77 - 79.9</td>
</tr>
<tr>
<td>B+</td>
<td>73 - 76.9</td>
<td>70 - 72.9</td>
</tr>
<tr>
<td>B</td>
<td>67 - 69.9</td>
<td>63 - 66.9</td>
</tr>
<tr>
<td>D+</td>
<td>below 60</td>
<td>60 - 62.9</td>
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Grades will not be based upon criteria such as need, appearance, race, age, sex, or social status. Once determined, grades will not be changed except in the case of clerical errors that cause the student’s true level of ability to be underestimated. Course grades may only be determined by the instructor of record.

TITLE IX STATEMENT:
Millersville University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to comply with the requirements of Title IX of the Education Amendments of 1972 and the University’s commitment to offering supportive measures in accordance with the new regulations issued under Title
I X, the University requires faculty members to report to the University’s Title IX Coordinator incidents of sexual violence shared by students. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report to the person designated in the University Protection of Minors policy sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred.

Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence is set forth at: www.millersville.edu/titleix

ATTENDANCE POLICY

MILLERSVILLE UNIVERSITY ATTENDANCE POLICY
EFFECTIVE SPRING 2003
Approved by Faculty Senate 12/4/02; Administrative approval 1/10/03

The University supports departmental and faculty class attendance policies that are reflective of and consistent with University approved guidelines. Faculty will include their class attendance policy in their syllabi given to all students in their classes at the start of the semester.

University approved guidelines:

1. Students are expected to attend all classes. It is the student’s responsibility to complete all course requirements even if a class is missed. If a student misses class for an officially excused reason, then he/she is entitled to make up the missed work but only at the convenience of the faculty member. Responsibility for materials presented in, assignments made for, and tests/quizzes given in regularly scheduled classes lies solely with the student.

2. The University policy is that faculty will excuse absences for the following reasons:
   a. personal illness,
   b. death or critical illness in the family,
   c. participation in a university-sponsored activity,
   d. jury duty,
   e. military duties, or
   f. religious holidays

3. Faculty judge the validity of student absences from class within the University’s approved guidelines and may require documentation for excused absences. Faculty will evaluate any reason, other than those listed above, for a student missing class and determine whether the absence is justified. In these circumstances, a student may make up missed work at the discretion of the instructor.

4. In the case of foreseeable absences, students are encouraged to notify the faculty member in advance. A student who will miss class due to participation in an official University activity must notify the instructor well in advance of the activity to assure that the absence is excused.

Appeals:
As with any academic issue, students may exercise their right to appeal adverse attendance decisions. Please refer to the current undergraduate catalog for the complete Academic Appeal procedure.

DEPARTMENT OF APPLIED ENGINEERING, SAFETY & TECHNOLOGY ATTENDANCE POLICY
Adopted May 4, 1998

Students are expected to attend all scheduled classes in accordance with the above policy. To the extent that this does not happen, the following shall apply:

1. The limit of unauthorized absences depends upon the number of scheduled days per week as follows:
   - Fall and spring semesters
     • three per semester for a course scheduled three days per week
     • two per semester for a course scheduled one or two days per week

2. The University’s attendance policy is that the student is expected to attend all classes.

3. Attendance is required for all scheduled classes.

4. Failure to meet attendance requirements may result in a failing grade for the course.

5. Faculty members are expected to exercise their discretion in applying the attendance policy.

6. Students who miss more than 10 percent of scheduled class time may be dropped from the course.

7. Students who miss more than 40 percent of scheduled class time may be administratively withdrawn from the course.

8. Students who miss more than 80 percent of scheduled class time are subject to dismissal from the University.

The University reserves the right to modify attendance requirements at any time.
Winter and summer sessions
• two per session

2. Each late arrival and early departure will count as one-half of an unauthorized absence.

3. Participation in outside-of-the-classroom educational activities and intercollegiate contests shall be communicated to the instructor prior to the absence. Failure to do so will convert these authorized absences to “unauthorized absences.”

4. Students whose “unauthorized” absences exceed the policy stated in item #1 are liable to dismissal from the course with a grade of 'F' or 'Z.'

ASSESSMENT OF COURSE OBJECTIVES (identified in italics following the objective)
After a series of planned experiences, the student will be able to:

1. Explore multiple disciplines of engineering and their applications in the 'real' world. (Examinations)

2. Collect and examine information from a variety of sources to determine what is relevant to the problem. (Design Activities)

3. Document the engineering design process by identifying the problem, design requirements, and strategies for solving the problem. (Design Activities)

4. Use mathematical and scientific concepts and calculations to determine appropriate solutions for fundamental engineering problems. (Design Activities and Examinations)

5. Explain a solution to a real-world problem in mathematical forms based on prioritized criteria and trade-offs that account for a range of constraints such as aesthetics, cost, efficiency, environmental impacts, and safety. (Design Activities and Examinations)

6. Analyze the benefits, limitations, and risks associated with resources available (or technologies proposed) to solve design and engineering problems. (Design Activities and Examinations)

7. Recognize and use scientific, engineering, and technological thinking (e.g. a set of intellectual processes and their results) to model design ideas and conduct laboratory experiments to test design prototypes. (Design Activities and Examinations)