**LONG SIGNATURE SHEET**

**Proposal Number:** ET 4-19-12

**Proposal Title:** Revision of Four-Year Mechanical Engineering Technology Undergraduate Curriculum

**Originating Department:** Engineering Technology

**TYPE OF PROPOSAL:** UNDERGRADUATE _X_ GRADUATE

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Revised 08/01/11
OAA/12
*To: Bruce Gehrig

From: Nan A. Byars MAB

Date: April 20, 2012

Re: Revision of Four-Year Mechanical Engineering Technology Undergraduate Curriculum

Attached please find a proposal to revise the undergraduate curriculum of the Mechanical Engineering Technology program.
A. PROPOSAL SUMMARY AND CATALOG COPY

1. Summary.
The Department of Engineering Technology proposes to modify the mechanical engineering technology curriculum to meet current trends and state of practice. This proposal eliminates five undergraduate courses and one laboratory course, while adding four new undergraduate lecture courses, two of which have an associated laboratory, a laboratory, and a one hour seminar. The proposed changes in the Mechanical Engineering Technology program are as follows:

- New required courses will be:
  - ETGR 1100L Engineering Technology Computer Applications Lab
  - ETGR 3295 Multidisciplinary Professional Development
  - ETME 1111 CAD Modeling 1
  - ETME 2100 Sophomore Design Practicum
  - ETME 2100L Sophomore Design Practicum Laboratory
  - ETME 3100 Junior Design Practicum
  - ETME 3100L Junior Design Practicum Laboratory
  - ETME 3150 Applied CAD Modeling & Simulation

- Eliminated undergraduate courses are:
  - ETGR 1100 Engineering Technology Computer Applications
  - ETGR 1103 Technical Drawing 1
  - ETME 2202 Introduction to Parametric Modeling
  - ETGR 3272 Numerical Methods
  - ETME 2156 Machine Shop Practices
  - ETME 2156L Machine Shop Practices Lab

As part of this curriculum revision proposal, a concentration in energy will be added. Students will have an option to take existing energy-related courses for their four major elective courses to satisfy the new energy concentration.

Changes will be made to some course numbers, titles, and descriptions to reflect a consistent numbering and notation for the new program sequence. Some courses include revised course pre/co-requisites or additional limitations and requirements, which are provided in this document. Overall, the BSET Mechanical Engineering Technology program requirements have increased from 124 credits to 128 credits. The changes outlined in this proposal are structured to meet minimum curriculum requirements for TAC of ABET accreditation. Course numbering and/or course titles will be modified for the existing courses as follows:

<table>
<thead>
<tr>
<th>Revised Course Number</th>
<th>Former Course Number</th>
<th>Revised Course Name</th>
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Revised 08/01/11
OAA/Iz
### Course Listings

<table>
<thead>
<tr>
<th>Course Code</th>
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<tr>
<td>ETME 1112</td>
<td>CAD Modeling 2</td>
</tr>
<tr>
<td>ETME 1104</td>
<td>Technical Drawing 2</td>
</tr>
<tr>
<td>ETME 2130</td>
<td>Materials &amp; Manufacturing 1</td>
</tr>
<tr>
<td>ETME 1101</td>
<td>Manufacturing Processes</td>
</tr>
<tr>
<td>ETME 2131</td>
<td>Materials &amp; Manufacturing 2</td>
</tr>
<tr>
<td>ETME 2101</td>
<td>Applied Materials</td>
</tr>
<tr>
<td>ETME 3123L</td>
<td>Stress Analysis Lab</td>
</tr>
<tr>
<td>ETME 3152</td>
<td>same</td>
</tr>
<tr>
<td>ETME 4143L</td>
<td>Thermodynamics &amp; Heat Transfer Lab</td>
</tr>
<tr>
<td>ETME 3252</td>
<td>same</td>
</tr>
<tr>
<td>ETME 3133L</td>
<td>Fluid Mechanics Lab</td>
</tr>
<tr>
<td>ETME 3151</td>
<td>same</td>
</tr>
<tr>
<td>ETME 4163L</td>
<td>Instrumentation &amp; Controls Lab</td>
</tr>
<tr>
<td>ETME 3251</td>
<td>same</td>
</tr>
<tr>
<td>ETME 4244</td>
<td>Applied Heat Transfer</td>
</tr>
<tr>
<td>ETME 3244</td>
<td>same</td>
</tr>
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</table>

### 2. Proposed Catalog Copy

**ETGR 1100L. Engineering Technology Computer Applications Laboratory.** (1) Introduces the use of computer applications required for engineering technologists. Topics include using the computer to solve technical problems, an introduction to engineering computer applications, the use of standard office software, and the use of scientific calculators.

**ETME 1111. CAD Modeling 1.** (3) Co-requisite: ETGR 1201. This course introduces the concepts of technical drawing and its relationship to the mechanical design process using a feature-based parametric modeler such as SolidWorks. Topics include sketching, orthographic projections, pictorial views, dimensioning techniques, and introduction to Computer-Aided-Design (CAD).

**ETME 1112. CAD Modeling 2.** (3) Prerequisites: ETME 1111 (C or better). This course is a continuation of ETME 1111 and introduces the student to advanced modeling techniques employed in Computer-Aided-Design (CAD). Topics include the use of linked features in drawings, traditional and geometric tolerancing, custom templates, assemblies, and basic animation.

**ETME 2100. Sophomore Design Practicum.** (2) Prerequisites (C or better) ENGL 1100, ETME 1111 and ETGR 1201. Co-requisites or prerequisites: ETME 1112, and ETME 2130. Co-requisite: ETME 2100L. A sophomore level design practicum focused on a simple, defined mechanical design challenge. Projects will be completed individually and introduce students to the design process, project management, machine shop fabrication techniques, memo style report writing and final project demonstrations. Additionally, the course will reinforce topics learned in previous courses such as CAD modeling, documentation generation (drawings) and analytical modeling.

**ETME 2100L. Sophomore Design Practicum Laboratory.** (1) Co-requisite: ETME 2100. A sophomore level design practicum focused on a simple, defined mechanical design challenge. Projects will be completed individually and introduce students to the design process, project management, machine shop fabrication techniques, memo style report writing and final project demonstrations. Additionally, the course will reinforce topics learned in previous courses such as CAD modeling, documentation generation (drawings) and analytical modeling.

**ETME 2102. Mechanisms.** (3) Prerequisites (C or better): ETME 1111, ETGR 2171, PHYS 1101. This course covers plane motion and devices used to generate plane motion. Topics include analysis of displacement, velocity, acceleration, gears, cams and other mechanical systems.

**ETME 2130. Applied Materials and Manufacturing 1.** (3) Prerequisites (C or better): ETGR 1201. Co-requisites or prerequisites: CHEM 1251. The courses in this series present a fusion of material science and the applied processes used to form engineering materials into useful products.
components or assemblies. This course is part 1 of a two segment series. This first course focuses on metallic materials with crystalline structure, and the specific processes used to form and finish these materials. Practical instruction in theory of machine tool operation, casting, rolling and joining is presented. Alloying, heat treatment, corrosion and operational environment appropriate for the subject materials is discussed.

ETME 2131. Applied Materials and Manufacturing II. (2) Prerequisites: ETME 2130 (C or better), CHEM 1251, STAT 1220. A continuation of Applied Materials and Manufacturing I. This course focuses on non-metallic materials, polymer based materials, ceramics, composite materials and materials with amorphous atomic structure. A fusion of material science and the applied processes used to form the subject engineering materials into useful components or assemblies is presented. Molding, autoclaving, polymer cross-linking and operational environment appropriate for the subject materials is discussed. Manufacturing quality systems are discussed. Two lecture hours per week.

ETME 3100. Junior Design Practicum. (2) Prerequisites: ENGL 1102, ETME 2100 and ETME 3133 (C or better). Co-requisites or prerequisites: ETME 3143, Co-requisite: ETME 3100L. A junior level design studio focused on a more complex, but still completely defined, thermo-fluids and energy system based design challenge. Projects will be completed in teams (2-3) and introduce students to group project dynamics, advanced machine shop techniques, data acquisition and analysis. Additionally, the course will reinforce topics learned in previous courses such as the design process, project management, formal report style writing, math modeling (Excel, MATLAB, MathCad and EES), documentation generation (Drawings + Procedure), final project demonstrations and analytical modeling.

ETME 3100L. Junior Design Practicum Laboratory. (1) Co-requisite: ETME 3100. A junior level design practicum focused on a more complex, but defined, thermo-fluids and energy system based design challenge. Projects will be completed in teams (3-4) and introduce students to group project dynamics, advanced machine shop techniques, data acquisition and analysis. Additionally, the course will reinforce topics learned in previous courses such as the design process, project management, formal report style writing, math modeling (Excel, MATLAB, MathCad and/or EES), documentation generation (Drawings + Procedure), final project demonstrations and analytical modeling. This course meets for one (1) three (3) hour laboratory session each week.

ETME 3113. Dynamics. (3) Prerequisites: ETGR 2272, ETGR 2101 (C or better), PHYS 1101 (C or better), and ETME 2102. The dynamic behavior of particles; translation, rotation and plane motion of a rigid body, the principles of conservation of energy and momentum.

ETME 3123. Strength of Materials. (3) Prerequisites: ETGR 2101 with a C or better, ETGR 2272. Stress-strain relationships resulting from direct loads, torsional loads and bending loads, and the results obtained from applying more than one of these loads simultaneously. Beam deflection and column loading.

ETME 3123L. Stress Analysis Laboratory. (1) (W) Prerequisite or co-requisite: STAT 1220, ETME 3123, Prerequisites: ENGL 1102 (C or better), ETGR 1100L (C or better). Experiments illustrating stress-strain relationships in engineering materials and the use of brittle coating, photoelasticity and electrical-resistance strain gages.

ETME 3133. Fluid Mechanics. (3) Prerequisite: ETGR 2272, ETGR 1100L & ETGR 2101 with a C or better. Fundamental principles of fluid mechanics. Topics include manometry,
buoyancy, forces on submerged bodies, boundary layers, flow over surfaces, Bernoulli's equation with applications, orifices, pipe losses and an introduction to hydrodynamics.

ETME 3133L. Fluid Mechanics Laboratory. (1) (W) Prerequisite or Corequisite: ETME 3133, Prerequisites: ENGL 1102 (C or better), & ETGR 1100L (C or better). Flow through conduits and hydraulic components and in open channels. The experimental determination of viscosity, viscous forces and resulting power losses. Flow measuring devices such as orifices, venturi tubes, anemometers and pitot tubes. Laminar and turbulent flow. Performance of rotating machines such as Pelton turbines, centrifugal fans and hydrostatic transmissions.

ETME 3143. Thermodynamics. (3) Prerequisite or Co-requisite ETME 3100 Prerequisites: ETGR 2272, CHEM 1251, ETME 3133 (C or better) Fundamentals of thermodynamics including work and heat; classical approach to first and second laws of thermodynamics; ideal gas, entropy, reversibility, irreversibility, and study of various processes and cycles.

ETME 3150. Applied CAD Modeling and Simulation. (3) Prerequisites: ETME 1112 (C or better), ETME 2102 Corequisites: ETME 3123 and ETME 3113. This course is a continuation of ETME 1112, and introduces the student to the use of some of the tools available for the analysis of parametrically-constructed CAD models. Topics include the finite element method, finite element analysis (FEA), the use of FEA for stress analysis, thermal analysis, and motion studies, and the important distinctions between FEA results, theoretical results, and experimental results.


ETME 4143L. Thermodynamics and Heat Transfer Laboratory. (1) (W) Prerequisites: ENGL 1102 (C or better), STAT 1220. Prerequisite or co-requisite: ETME 3143, ETME 4244. Experimentation involving the fundamental principles of thermodynamics and heat transfer, as applied to internal combustion engines, steam engines, engine dynamometers, refrigeration and heat pumps, solar energy systems, and heat exchangers. Three laboratory hours per week.

ETME 4163. Instrumentation and Controls. (3) Prerequisites: ETGR 2106, ETGR 2122, ETGR 2272. Introduction to instrumentation for measurement and control of physical variables, with emphasis on electronic systems. Electrical instruments, signal conditioning circuits, sensors, measurement principles and data acquisition using high level language such as LabVIEW are investigated. Analog and computer-based controllers including PID are introduced. Discrete state controllers such as Programmable Logic Controllers (PLC) are taught from a systems point of view. Topics include Wheatstone bridge, H-Bridge, op-amps, thermal, mechanical, optical sensors, PLC and PID controllers.

ETME 4163L. Instrumentation Laboratory. (1) (W) Prerequisite or co-requisite: ETME 4163. Prerequisites: ENGL 1102 (C or better), STAT 1220. Practice in the use of the various instrumentation devices studied in ETME 4163.

ETGR 4100. Capstone Design Project I. (2) (W, O) Prerequisites: All freshman, sophomore and junior level technical courses. Pre- or co-requisite: ETME 4163, ETME 4244. First of a two-
semester course sequence in which student teams will implement a senior-level design project which demonstrates abilities as developed by the coursework taken thus far. Project planning techniques will be utilized to make substantial progress toward implementation of a design solution. One class hour and three lab hours per week.

**ETGR 4200. Capstone Design Project II.** (2) (W, O) Prerequisite: ETGR 4100. Second of a two-semester course sequence in which student teams will continue to implement a senior-level design project which demonstrates abilities as developed by the coursework taken thus far. The design solution developed in the first semester will be completed and evaluated during the second semester. The primary engineering results delivered will be a set of rational decisions, where the rationale of those decisions will be supported by the appropriate analysis and testing. The quality of the design will usually be reflected in a prototype of either the hardware or software system. One class hour and three lab hours per week.

**ETGR 3295. Multidisciplinary Professional Development** (1) Prerequisite: Senior or Junior standing. A series of multidisciplinary and disciplinary seminars and activities designed to introduce students to basic concepts of professionalism in engineering. Topics include global, societal, and contemporary issues of current interest such as leadership, entrepreneurship, ethics, cultural diversity, and professional licensure.


**B. JUSTIFICATION.**

1. **Need.**

   The Department of Engineering Technology and Construction Management at UNC Charlotte has provided a high quality technical education for over 30 years, with several of the department’s programs satisfying rigorous accreditation standards through TAC/ABET. The proposed revision to the Mechanical Engineering Technology program curriculum allows us to simultaneously continue this tradition of quality education of the region’s engineering technologists while making the program more current and technically relevant.

   The proposed curriculum revision addresses deficiencies commonly cited by industry in engineering and technology programs nationally and addresses changes in specialized accreditation standards and best practices; namely, the lack of practical instruction and application in the areas of communication skills, project management, and holistic project development and realization. The revision exposes students to a cohesive and integrated treatment of important topics necessary for their success as practicing engineering technologists. It affords them the flexibility to specialize in an area of interest, such as energy or machine design, through the choice of major electives in the senior year. The new vertically integrated design sequence beginning in the freshman year allows students to participate in a meaningful capstone experience, including industry sponsored and/or interdisciplinary design projects. Finally, graduates of the revised curriculum will be better prepared to pursue professional accreditation and graduate studies.

2. **Prerequisites/Co-requisites.**

   Courses identified in this proposal are freshman, sophomore, junior, and senior level. Prerequisites and co-requisites have been established, where warranted, and are indicated in the course descriptions provided. Pre- and co-requisites are necessary for successful
knowledge transfer and assimilation and to satisfy all applicable accreditation standards and requirements.

3. **Course Numbering.**
   Course numbering in this proposal is consistent with the university policy for undergraduate courses and the level of academic achievement of students for whom it is intended.

4. **Improvement of Scope, Quality and Efficiency of Program and Instruction.**
   The revised curriculum offers a comprehensive, integrated, and relevant yet flexible program that is broad-based. It reflects current technologies, knowledge, and skills desired by employers and required for specialized accreditation. It also better prepares graduates to pursue professional licensure and graduate studies.

C. **IMPACT**

1. **Students Served.**
   Undergraduate students pursuing Mechanical Engineering Technology will be served by this proposal. Junior level transfer students with appropriate Associate of Applied Science (AAS) degrees will be able to matriculate into the on-campus four-year program under the department’s existing 2+2 transfer arrangement.

2. **Effect on Existing Courses and Curricula.**
   a. **Added Courses**
      New courses and laboratories will be taught on-campus on an annual basis beginning in Fall 2012.
   
   b. **Other Courses**
      The content and frequency of courses that have been renumbered will not be affected. Currently offered courses that are not identified as part of the revised curriculum will be discontinued. No substantive topical content or material currently provided will be removed.
   
   c. **Anticipated Enrollment in Added Courses**
      Since this proposal details a revision of the current MET curriculum, enrollment in new courses will be consistent with enrollment in the current curriculum. It is anticipated that the MET enrollment will increase by about 5% per year.
   
   d. **Effect on Other Course Enrollment**
      Enrollments in courses outside of the Department of Engineering Technology and Construction Management are expected to increase commensurate with the increase in MET enrollment.
   
   e. **Special Topics Courses**
      None of the courses in this proposal have been previously offered under special topic numbering.
   
   f. **Other Catalog Copy Changes**
      Proposed changes and additions to catalog copy, which will reflect curriculum outlines, course requirements, and program requirements, are as follows:

Revised 08/01/11
OAA/lz
Current catalog copy from 2011-2012 online catalog:
Disciplines of study in Engineering Technology at UNC Charlotte include: [...]

Mechanical Engineering Technology. Mechanical Engineering Technology includes technical
and mechanical drawing, computer-aided design, machine design, manufacturing and machine
processes, fluid power systems, statics and strength of materials, mechanisms, stress analysis,
instrumentation and controls, thermodynamic systems, heat transfer, dynamics, methods analysis
and engineering economics.

Revised catalog copy:
Disciplines of study in Engineering Technology at UNC Charlotte include: [...]

Mechanical Engineering Technology. Mechanical Engineering Technology includes technical
and mechanical drawing, computer-aided design, machine design, manufacturing and machine
processes, fluid power systems, statics and strength of materials, mechanisms, stress analysis,
instrumentation and controls, thermodynamic systems, energy, heat transfer, dynamics, methods
analysis and engineering economics.

A concentration in applied energy is available in which students may focus their major elective
courses by choosing to take four energy-related courses, including:

ENER 4245 Energy Management
ENER 4250 Analysis of Renewable Energy Systems
ENER 4260 Hydrogen Production and Storage
ENER 4275 Air Conditioning Systems
ENER 4270 Fuel Cell Technology
Other courses as approved

Current catalog copy from 2011-2012 online catalog:

Discipline Specific Prerequisites:
Mechanical

Drafting/Computer Aided Drafting
• Machine Processes
• Statics
• Metallurgy or Engineering Materials
• Kinematics or Mechanisms
• Basic Electrical Circuits (in addition to Physics II)
• Computer Programming (using a higher level language such as Visual Basic, FORTRAN,
or C++)

Revised catalog copy:
Discipline Specific Prerequisites:
Mechanical

Revised 08/01/11
OAA/lz
- 3D Parametric Modeling
- Manufacturing Processes
- Machine Shop Practices
- Introduction to Design
- Statics
- Metallurgy or Engineering Materials
- Kinematics or Mechanisms
- Basic Electrical Circuits (in addition to Physics II)
- Computer Programming (using a higher level language such as Visual Basic, FORTRAN, or C++)

Revised catalog copy:

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<td>PHYS 1101 Physics I</td>
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<td>ETGR 1103L Engineering Computer Apps</td>
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<td>MATH 1103 Precalculus</td>
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|                          | Sophomore Year                                             |
|                          | Fall Semester                                                | Spring Semester                                           |
| Course                   | Credit            | Course                     | Credit                             |
| ETME 2100 Sophomore Design | 2               | ETME 2102 Mechanisms       | 3                                 |
| ETME 2100L Sophomore Design Lab | 1          | ETGR2272 Engineering Analysis 2 | 3                               |
| ETGR 2101 Applied Mechanics 1 | 3            | ETGR 2122 Technical Programming | 3                                |
| STAT 1220 Elements of Statistics | 3      | ETME 2131 Materials & Manufacturing 2 | 2                           |
| ETME 2130 Materials & Manufacturing 1 | 3     | ETGR 2106 Electronic Devices & Circuits | 3                             |
| CHEM 1251 Principles of Chemistry | 3        | LBST 2102 Western Culture & History(2) | 3                            |
| TOTAL                    | 15               | TOTAL                      | 17                                |

|                          | Junior Year                                                 |
|                          | Fall Semester                                                | Spring Semester                                           |
| Course                   | Credit            | Course                     | Credit                             |
| ETME 3123 Strength of Materials | 3             | ETME 3100 Junior Design    | 2                                 |
| ETME 3113 Dynamics        | 3               | ETME 3100L Junior Design Lab | 1                               |
| ETME 3133 Fluid Mechanics | 3               | ETME 3143 Thermodynamics   | 3                                 |
| ETME 3123 Stress Analysis Laboratory | 1               | ETGR3222 Engineering Economics | 3                               |
| ETGR3071 ET Professional Seminar (W) | 1   | ETME 3133L Fluid Mechanics Laboratory | 1                             |
| ETGR 3171 Engineering Analysis 3 or ETGR 4272 Engineering Analysis 4 | 3 | ETME 3213 Machine Design 1 | 3                              |
| ETME 3150 Modeling & Simulation | 3         | LBST 110X Arts & Society(2) | 3                               |
| TOTAL                    | 17               | TOTAL                      | 16                                |

Revised 08/01/11
OAA/lz
D. RESOURCES REQUIRED TO SUPPORT PROPOSAL

1. Personnel
   a. New Instructional Requirements and Impact on Present Faculty Load
      Currently, nine full-time faculty members deliver the MET program. There will be no additional faculty requirements and present faculty load will be unchanged.

   b. Qualified Faculty Interested in Teaching New Courses
      Current full-time MET faculty consist of: Nan Byars, Rodney Handy, Dan Hoch, Ted Jarrell, Ronald Priebe, Peter Schmidt, Ahmad Sleiti, Patricia Tolley, and Wes Williams. Primary faculty and additional support for courses are provided in the table below.

<table>
<thead>
<tr>
<th>Course</th>
<th>Primary Faculty</th>
<th>Other Qualified Faculty</th>
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<tbody>
<tr>
<td>ETME 1111</td>
<td>Jarrell</td>
<td>Williams, Schmidt</td>
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<td>ETME 2100</td>
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<td>Hoch, Jarrell, Priebe, Williams</td>
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<td>ETME 3100</td>
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</tr>
<tr>
<td>ETME 3150</td>
<td>Jarrell</td>
<td>Williams, Schmidt</td>
</tr>
</tbody>
</table>

2. Physical Facility.
   No new facilities will be required to implement the proposed curriculum. Additional specialized laboratories will be brought online as part of regular program enhancement as funds become available.

3. Equipment and Supplies.
   No additional equipment and supplies will be required to implement the proposed curriculum.

No additional computers or software will be required to implement the proposed curriculum.

5. **Audio-Visual.**
   No additional audio-visual capabilities will be required to implement the proposed curriculum.

6. **Other Resources.**
   No additional resources will be required to implement the proposed curriculum.

7. **Funding Sources for New/Additional Resources.**
   No funding is required for new or additional resources to implement the proposed curriculum.

E. **CONSULTATION WITH THE LIBRARY AND OTHER DEPARTMENTS OR UNITS**
   1. **Library Consultation.**
      The Atkins Library reference staff was contacted in reference to this proposal. They have indicated that existing library holdings are adequate to support the proposal. The Consultation on Library Holdings dated March 20, 2012 is included in Appendix G1 of this document.

   2. **Consultation with Other Departments or Units.**
      The proposed curriculum revision will entail no additional assistance or support from other departments or units beyond what is currently incorporated into the MET program.

F. **INITIATION AND CONSIDERATION OF THE PROPOSAL**
   1. **Originating Unit.**
      The Department of Engineering Technology faculty unanimously approved this curriculum proposal on April 4, 2012.

   2. **Other Considering Units.**
      The Mechanical Engineering Technology Industrial Advisory Board reviewed and approved the proposed curriculum during the Spring 2011 meeting.

G. **ATTACHMENTS**
   1. Consultation Documentation.
   2. Proposed Course Outlines.
Appendix G1: Consultation Documentation

J. Murrey Atkins Library

Consultation on Library Holdings

To: Peter Schmidt
From: Alison Bradley
Date: 3/20/12
Subject: MET Curriculum: Proposed changes

Summary of Librarian’s Evaluation of Holdings:

Evaluator: Alison Bradley    Date: 3/20/12

Check One:
1. Holdings are superior
2. Holdings are adequate

x

3. Holdings are adequate only if Dept. purchases additional items.

4. Holdings are inadequate

Comments:
Library holdings should be adequate to support student research in the new proposed curriculum for Mechanical Engineering Technology. Many of the changes do not significantly alter the research content for students’ work, and proposed expansions into areas like project management, communication, or applied energy are supported by library purchasing for the College of Business, EPIC, and other areas. (See attached list of holdings by LC Subject.) Databases like Compendex, Inspec, IEEE Xplore, ASTM Digital Library, and Business Source Premier (among others) are available to all UNCC students. Librarian support for students taking Sophomore and Junior Design or the Capstone project will ensure that students are able to fully realize the value of research collections available to them. Students who elect to study topics outside of the library’s focus have access to materials via Interlibrary Loan and consortial borrowing as well.

Alison Bradley

Evaluator’s Signature

3/20/12

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## Current Library Holdings by Subject

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<th>LC Subject Heading</th>
<th>Total items</th>
<th>Periodicals</th>
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<tr>
<td>Computer Programming</td>
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Appendix G2: Proposed Course Outlines
ETME 1111 CAD Modeling 1

Catalog Data  This course introduces the concepts of technical drawing and its relationship to the mechanical design process using a feature-based parametric modeler such as SolidWorks. Topics include sketching, orthographic projections, pictorial views, dimensioning techniques, and introduction to Computer-Aided-Design (CAD).

References  


Goals  This is the first of a three-course sequence that introduces the concepts and techniques in the use of parametric CAD modeling. Emphasis is placed on the development of core competencies of visualization, construction of solid models, and development of engineering drawings from these solid models.

Corequisite  ETGR 1201 Introduction to Engineering Technology

Class Topics  The following topics are presented in this course:
- Basic sketching techniques
- Orthographic projection
- Pictorial projections
- Use of sketch planes
- Dimensional and geometric parameters
- Feature history tree
- Construction and use of part templates
- Parent and child feature relations
- Reference geometry
- Drawing documents
- Patterned features
- Customizing and use of drawing templates

Outcomes  Upon successful completion of this course, students will be able to:
1. Use appropriate methods to prepare orthographic and pictorial sketches.
2. Construct fully-defined solid geometry features.
3. Generate mechanical drawings from part document files.

Course Outcomes 1 through 4 above support achievement of Program Outcome 1.

Proficiency is demonstrated by means of an end-of-term examination.

Computer Usage  Course is based on developing proficiency with a feature-based parametric modeling CAD system

Laboratory  None

Design Content  None

Grading  To be determined by instructor

Follow-up  ETME 1112 CAD Modeling 2
Courses  ETME 3100 CAD Modeling and Simulation

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ETME 1112 CAD Modeling 2

Catalog Data
This course is a continuation of ETME 1111 and introduces the student to advanced modeling techniques employed in Computer-Aided-Design (CAD). Topics include the use of linked features in drawings, traditional and geometric tolerancing, custom templates, assemblies, and basic animation.

References


Goals
This is the second of a three-course sequence that introduces the concepts and techniques in the use of parametric CAD modeling. Emphasis is placed on the development of core competencies of the use of variable parameters, dimensional and tolerateded callouts, assemblies and animation, and the construction of more complex mechanical components based on their drawing and design specifications.

Prerequisites
ETME 1111 CAD Modeling 1 (C or better)
ETGR 1201 Introduction to Engineering Technology (C or better)

Class Topics
The following topics are presented in this course:
- Specification of user-defined part and drawing templates
- Use of linked data in drawings
- Use of conventional plus/minus tolerancing
- Use of geometric dimensioning and tolerancing (GD & T)
- Parametric variables used in geometry construction
- Assemblies
- Basic animation and rendering
- Motion analysis
- Multi-body solids
- Complex sweeps and lofts
- Sheet metal
- Weldments

Outcomes
Upon successful completion of this course, students will be able to:
1. Prepare and modify customized part and template files.
2. Import linked information into drawings.
3. Properly dimension and tolerance mechanical drawings using conventional and GD & T methods.
4. Employ links and equation variables to define feature geometry.
5. Construct assemblies from multiple components.
6. Construct advanced solids such as bridged multi-body solids, 3-d sweeps, and sheet metal components.

Course Outcomes 1 through 6 above support achievement of Program Outcome 1.

Proficiency is demonstrated by an end-of-term examination.

Computer Usage
Course is based on developing extended proficiency with a feature-based parametric modeling CAD system

Laboratory
None

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ETME 2100 – Sophomore Design Practicum

Catalog Data
A sophomore level design practicum focused on a simple, defined mechanical design challenge. Projects will be completed individually and introduce students to the design process, project management, machine shop fabrication techniques, memo style report writing and final project demonstrations. Additionally, the course will reinforce topics learned in previous courses such as CAD modeling, documentation generation (drawings) and analytical modeling. This course meets for two (2) lecture hours per week. Two (2) credit hours.

References

Goals
This is a part of the first module of a three-part sequence that introduces the fundamental concepts and techniques used in the design of mechanical systems to solve a given problem. This course introduces the design process and its integration with the project management process.

Prerequisite
ETGR 1201: Introduction to Engineering Technology (C or better)
ETME 1112: CAD Modeling 2 for MET
(or Co-requisite) ETME 2100: Applied Materials and Manufacturing I
(or Co-requisite) CHEM 1251: Chemistry
Co-requisite ETME 2100L: Sophomore Design Practicum Laboratory

Class Topics
After an introduction to design concepts, the following topics will be investigated:

- The Design Process
- Gathering Design Requirements and Specifications
- Project Scheduling
- Practical Machining Instruction
- Print Reading
- Manufacturing Tolerances
- Geometric Dimensioning and Tolerancing
- Report Writing
- Presentations

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

5. Demonstrate an understanding of the design process.
6. Demonstrate an understanding of fundamental machining processes.
7. Display proficiency in the use of project management software.
8. Display proficiency in report writing.

Computer Usage
Project Management Software, CAD Modeling Software, Word Processing Software

Laboratory
Co-requisite, ETME 2100L: Sophomore Design Practicum Laboratory

Design Content
Students will be required to analyze a design problem, create a solution, fabricate the solution and then demonstrate the success of their design.

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Grading  
To be determined by instructor

Follow-up Courses  
ETME 3150: Applied CAD Modeling and Simulation  
ETME 3100: Junior Design Practicum  
ETME 3100L: Junior Design Practicum Laboratory  
ETGR 4100/4200: Senior Design

Note: Texts for this course will also be used in ETME 3100 and ETME 3100L

**ETME 2100L – Sophomore Design Practicum Laboratory**

Catalog Data  
A sophomore level design practicum focused on a simple, defined mechanical design challenge. Projects will be completed individually and introduce students to the design process, project management, machine shop fabrication techniques, memo style report writing and final project demonstrations. Additionally, the course will reinforce topics learned in previous courses such as CAD modeling, documentation generation (drawings) and analytical modeling. This course meets for one (1) three hour lab session each week. One (1) credit hour.

References  

Goals  
This is a part of the first module of a three-part sequence that introduces the fundamental concepts and techniques used in the design of mechanical systems to solve a given problem. This course introduces the students to machining processes in a laboratory setting.

Prerequisite  
ETGR 1201: Introduction to Engineering Technology (C or better)  
ETME 1112: CAD Modeling 2 for MET  
(or Co-requisite) ETME 2100: Applied Materials and Manufacturing I  
(or Co-requisite) CHEM 1251: Chemistry  
Co-requisite ETME 2100: Sophomore Design Practicum

Class Topics  
After an introduction to design concepts, the following topics will be investigated:

- The Design Process  
- Gathering Design Requirements and Specifications  
- Project Scheduling  
- Practical Machining Instruction  
- Print Reading  
- Manufacturing Tolerances  
- Geometric Dimensioning and Tolerancing  
- Report Writing  
- Presentations

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

9. Demonstrate an understanding of the design process.  
10. Demonstrate an understanding of fundamental machining processes.  
11. Demonstrate proficiency in machining and fabrication of mechanical assemblies.

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Computer Usage
Project Management Software, CAD Modeling Software, CNC Machining Software, RP Software

Laboratory
1 session per week, supervised by the machine shop manager

Design Content
Students will be required to analyze a design problem, create a solution, fabricate the solution and then demonstrate the success of their design.

Grading
To be determined by instructor

Follow-up Courses
ETME 3150: Applied CAD Modeling and Simulation
ETME 3100: Junior Design Practicum
ETME 3100L: Junior Design Practicum Laboratory
ETGR 4100/4200: Senior Design

Note: Texts for this course will also be used in ETME 3100 and ETME 3100L

ETGR 2106 Circuits and Devices

Catalog Data
This course provides an introduction to AC and DC circuits. Simple series and series-parallel circuits will be used to illustrate applications of Ohm’s Law and Kirchhoff’s Laws. Power in DC resistive circuits will be discussed. Sine waves, complex numbers, and phasors will be introduced to show the application to AC circuit analysis. Capacitors and inductors and their effects will be covered.

References
Boylestad’s Introductory Circuit Analysis, 2010 (ISBN 0137146663)

Goals
This is the first course for Mechanical Engineering Technology students that covers the fundamental concepts and laws that govern electricity in circuits. Emphasis will be placed on developing a strong foundation in DC circuits, with analogous AC applications being introduced later in the course.

Prerequisite
PHYS 1102 (C or better), MATH 1100 (C or better)

Class Topics
After a review of the basic physical model of electricity, the following topics will be investigated:
- Ohm’s Law
- Kirchhoff’s Voltage and Current Laws
- Effective Resistances in Series and Parallel
- Tools for Measuring Electrical Properties: Multimeter
- Capacitors
- High Pass and Low Pass Filters
- Diodes and Transistors
- Characteristics of AC Circuits
- Tools for Measuring Electrical Properties: Oscilloscope
- Inductors
- AC Circuit Analysis: Ohm’s Law, Series-Parallel Combinations, Nodal and Mesh Analysis

Outcomes
Upon successful completion of this course, students will be able to:
1. Demonstrate an understanding of fundamental laws for analyzing DC circuits
2. Proficiently apply KVL and KCL to determine nodal voltages, effective resistances for series and parallel components.

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3. Read a series-parallel schematic of a DC circuit and be able to determine the types of components and calculate relevant properties (nodal voltages, currents, etc.)

4. Demonstrate an understanding of basic parameters of AC, frequency, period, amplitude peak-peak, and amplitude RMS.

**Computer Usage**  
Engineering Equation Solver, Multisim,

**Laboratory**  
None, though in class demonstrations will be included reinforce concepts covered in the lecture.

**Grading**  
To be determined by instructor

**Follow-up Courses**  
ETME 3163: Instrumentation and Controls

**ETME 2130 Applied Materials and Manufacturing I**

**Catalog Data**  
The courses in this series present a fusion of material science and the applied processes used to form engineering materials into useful components or assemblies. This course is part 1 of a two segment series. This first course focuses on metallic materials with crystalline structure, and the specific processes used to form and finish these materials. Practical instruction in theory of machine tool operation, casting, rolling and joining is presented. Alloying, heat treatment, corrosion and operational environment appropriate for the subject materials is discussed. Three lecture hours per week. Three (3) credit hours. (Fall)

**References**  

**Goals**  
This is the first of a two-part sequence that introduces the fundamental concepts and processes used to manipulate engineering materials for manufacturing purposes. Emphasis will be placed on metallic materials and the processes used to shape them into manufactured goods.

**Prerequisite**  
ETGR 1201: Introduction to Engineering Technology (C or better)  
(or Co-requisite) CHEM 1251: Chemistry

**Class Topics**  
After an introduction to basic manufacturing concepts, the following topics will be investigated:
- Metallic Microstructure, Crystalline materials
- Nature of Metals and Alloys
- Ferrous Metal Phase Diagrams
- Heat Treatment
- Ferrous Metals and Alloys
- Nonferrous Metals and Alloys
- Metallic Material Selection
- Metal Casting
- Metal Forming
- Powdered Metal Process
- Additive Manufacturing with Metallic Materials
- Machining Processes
- Joining and Welding

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• Brazing and Soldering
• Measurement and Inspection

Outcomes

Upon successful completion of this course, students will be able to:
12. Demonstrate an understanding of fundamental manufacturing processes used with metallic materials.
13. Display proficiency in the terminology of these processes.
14. Demonstrate an understanding of how the processes investigated in this course affect design decisions

Computer Usage

None

Laboratory

None

Design Content

Students will be required to visit the Capstone Course Design Exposition and apply knowledge gained in the course to propose a manufacturing method for some component viewed as a part of the Exposition.

Grading

To be determined by instructor

Follow-up Courses

ETME 2200: Applied Materials and Manufacturing II
ETME 3123: Strength of Materials
ETME 2100 Sophomore Design Practicum

ETME 2131 Applied Materials and Manufacturing II

Catalog Data

The courses in this series present a fusion of material science and the applied processes used to form engineering materials into useful components or assemblies. This course is part 2 of a two segment series. This course focuses on non-metallic materials with polymer structure, and the specific processes used to form and finish these materials. Practical instruction in theory of molding, layup and continuous processing presented. Crosslinking, compounding, specification using ASTM – D-2000 and ASTM-D-4000 and operational environment appropriate for the subject materials is discussed. Manufacturing quality Systems are discussed. Two lecture hours per week. Two (2) credit hours. (Spring)

References


Goals

This is the second of a two-part sequence that introduces the fundamental concepts and processes used to manipulate engineering materials for manufacturing purposes. Emphasis will be placed on non-metallic materials and the processes used to shape them into manufactured goods.

Prerequisite

ETME 2100: Applied Materials and Manufacturing I
CHEM 1251: Chemistry
(Pre or Corequisite) STAT 1220: Statistics

Class Topics

After an introduction to basic manufacturing concepts, the following topics will be investigated:
• Non-metallic Microstructure, Polymeric materials
• Thermoplastic and Thermosetting behavior

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- Ceramics and Glasses
- Non-metallic Material Selection
- Molding
- Bulk Forming Processes
- Additive Manufacturing with Non-metallic Materials
- Chemical and Electrochemical Manufacturing Processes
- Adhesives and Bonding
- Surface Engineering
- Micro/Nano Manufacturing
- Lean Engineering
- Quality Engineering Systems

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

15. Demonstrate an understanding of fundamental manufacturing processes used with non-metallic materials.
16. Display proficiency in the terminology of these processes.
17. Demonstrate an understanding of how the processes investigated in this course affect design decisions

Computer Usage  
Excel for statistical analysis and process control methods.

Laboratory  
None

Design Content  
Students will be required to visit the Capstone Course Design Exposition and apply knowledge gained in the course to propose a manufacturing method for some component viewed as a part of the Exposition.

Grading  
To be determined by instructor

Follow-up Courses  
ETME 3123: Strength of Materials
ETME 3213: Machine Design I
ETME 3200: Junior Design Practicum

**ETME 3100 – Junior Design Practicum**

Catalog Data  
A junior level design practicum focused on a more complex, better defined, thermo-fluids and energy system based design challenge. Projects will be completed in teams (3-4) and introduce students to group project dynamics, advanced machine shop techniques, data acquisition and analysis. Additionally, the course will reinforce topics learned in previous courses such as the design process, project management, formal report style writing, math modeling (Excel, MATLAB, MathCad and EES), documentation generation (Drawings + Procedure), final project demonstrations and analytical modeling. This course meets for two (2) lecture hours per week with one three (3) hour laboratory session. Three (3) credit hours.

References  

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Goals
This is the second of a three-part sequence that reinforces the fundamental concepts and techniques used in the design of mechanical systems to solve a given problem. This course also continues to expose the students to machining processes in a laboratory setting.

Prerequisite
- ETME2100: Sophomore Design Practicum
- ETME2100L: Sophomore Design Practicum Laboratory
- ETME3133: Fluid Mechanics (C or better)
- (or Co-requisite) ETME 3143: Thermodynamics (C or better)
- Co-requisite ETME 3100L: Junior Design Practicum Laboratory

Class Topics
After a review of design concepts, the following topics will be investigated:

- The Design Process
- Gathering Design Requirements and Specifications
- Project Scheduling
- Practical Machining Instruction
- Print Reading
- Manufacturing Tolerances
- Geometric Dimensioning and Tolerancing
- Report Writing
- Presentations

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

18. Demonstrate an understanding of the design process.
19. Demonstrate an understanding of advanced machining processes.
20. Demonstrate an understanding of team dynamics.
21. Display proficiency in the use of project management software.
22. Display proficiency in report writing.
23. Display proficiency in analytical modeling.

Computer Usage

Laboratory
1 session per week, supervised by the machine shop manager

Design Content
Students will be required to analyze a design problem, create a solution, fabricate the solution and then demonstrate the success of their design.

Grading
To be determined by instructor

Follow-up Courses
ETGR 4100/4200: Senior Design

Note: Texts for this course will also be used in ETME 2100 and 2100L

ETME 3100L – Junior Design Practicum Laboratory

Catalog Data
A junior level design practicum focused on a more complex, but defined, thermo-fluids and energy system based design challenge. Projects will be completed in teams (3-4) and introduce students to group project dynamics, advanced machine shop techniques, data acquisition and analysis. Additionally, the course will reinforce topics learned in previous courses such as the design process, project management, formal report style writing, math modeling (Excel, MATLAB, MathCad and EES), documentation generation (Drawings +

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Procedure), final project demonstrations and analytical modeling. This course meets for one (1) three (3) hour laboratory session each week. One (1) credit hour.

References


Goals

This is a part of the second module of a three-part sequence that introduces the fundamental concepts and techniques used in the design of mechanical systems to solve a given problem. This course also continues to expose the students to machining processes in a laboratory setting.

Prerequisite

ETME2100: Sophomore Design Practicum
ETME2100L: Sophomore Design Practicum Laboratory
ETME3133: Fluid Mechanics (C or better)
(or Co-requisite) ETME 3143: Thermodynamics (C or better)
Co-requisite ETME 3100: Junior Design Practicum

Class Topics

After an introduction to design concepts, the following topics will be investigated:

- The Design Process
- Gathering Design Requirements and Specifications
- Project Scheduling
- Practical Machining Instruction
- Print Reading
- Manufacturing Tolerances
- Geometric Dimensioning and Tolerancing
- Report Writing
- Presentations

Outcomes

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

24. Demonstrate an understanding of the design process.
25. Demonstrate an understanding of advanced machining processes.
26. Demonstrate proficiency in machining and fabrication of mechanical assemblies.

Computer Usage

Project Management Software, CAD Modeling Software, CNC Machining Software, RP Software

Laboratory

1 session per week, supervised by the machine shop manager

Design Content

Students will be required to analyze a design problem, create a solution, fabricate the solution and then demonstrate the success of their design.

Grading

To be determined by instructor

Follow-up Courses

ETGR 4100/4200: Senior Design

Note: Texts for this course will also be used in ETME 2100 and 2100L

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ETME 3150 Applied CAD Modeling and Simulation

Catalog Data
This course is a continuation of ETME 1112, and introduces the student to the use of some of the tools available for the analysis of parametrically-constructed CAD models. Topics include the finite element method, finite element analysis (FEA), the use of FEA for stress analysis, thermal analysis, and motion studies, and the important distinctions between FEA results, theoretical results, and experimental results.

References

Notes and assignments developed and written by course professors.

Goals
This is the last of a three-course sequence that introduces the concepts and techniques in the use of parametric CAD modeling. Emphasis is placed on the development of core competencies of becoming familiar with the Finite Element Method and its strengths and limitations, interpretation of results, and its use in strength of materials, thermodynamics, and motion analysis problems.

Prerequisites
ETME 1112 CAD Modeling 2 (C or better)
ETME 2102 Mechanisms

Pre/Corequisite
ETME 3123 Strength of Materials

Class Topics
The following topics are presented in this course:
- The Finite Element Method--the one-dimensional case
- Interpretation and validation of results
- Types of elements
- Modeling technique
- Symmetry and problem simplification
- Strength of materials/machine design problems
- Thermal studies
- Motion studies
- Assemblies

Outcomes
Upon successful completion of this course, students will be able to:
27. Recognize and understand the use of the different element types.
28. Understand the limitations of finite element analysis.
29. Prepare and analyze a model using the appropriate boundary conditions and meshing criteria based on a given problem scenario.
30. Compare the results of an FEA study with the results of the classical equations for interpretation.
31. Simplify models where appropriate so that FEA solution time is improved.

Course Outcomes 1 through 5 above support achievement of Program Outcome 1.

Computer Usage
Course is based on developing extended proficiency with a feature-based parametric modeling CAD system; use of spreadsheet and word processing software is occasionally used for organizing data and presenting assignments.

Laboratory
None

Design Content
Students are required to develop skills necessary for recognizing when feature geometry can or cannot be safely excluded from analysis. This requires some elements of mechanical design.

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ETGR 1100L  Engineering Technology Computer Applications Laboratory

Catalog Data  Introduces the use of computer applications required for engineering technologists. Topics include using the computer to solve technical problems, an introduction to engineering computer applications, the use of standard office software, and the use of scientific calculators.

References  Thompson's Excel/Word bundle Microsoft Office Word 2010, Microsoft Office Excel 2010

Goals  To introduce students to computer applications used by engineering technologists for solving technical problems, including standard office applications such as Word, PowerPoint, Project, Visio, and Excel. Also covered are the use of scientific calculators and various engineering applications software, such as Google Sketch and MultiSim.

Corequisite  ETGR 1201 Introduction to Engineering Technology

Class Topics  The following topics are presented in this course:
- Report preparation using Word
- Problem solving using Excel
- Professional presentations using PowerPoint
- Project planning using Project
- Flowcharts using Visio
- Problem solving using calculators
- Simple circuits using MultiSim

Outcomes  Upon successful completion of this course, students will be able to:
1. Using a calculator, plot a two dimensional function and solve three simultaneous equations.
2. Create Word documents including tables, inserted images, equation editor, appropriate use of fonts, spacing, and tabs.
3. In Excel, use basic functions such as sum and average, perform calculations using multiple columns of data, and use IF statements.
4. Use PowerPoint to produce profession quality presentations.
5. Use Visio to create flow charts and simple graphics to enhance professional reports.
6. Use MultiSim software package to create and simulate simple electrical circuits

Proficiency is demonstrated by means of an end-of-term examination.

Computer Usage  This is a computer lab. Students will use Microsoft Word, Excel, Project, PowerPoint, and Visio; MultiSim and other software as appropriate

Laboratory  Course will meet in one of a number of available computer laboratories.

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Design Content None

Grading To be determined by instructor

ETGR 3295 Multidisciplinary Professional Development

Catalog Data Prerequisite: Senior or Junior standing. A series of multidisciplinary and disciplinary seminars and activities designed to introduce students to basic concepts of professionalism in engineering. Topics include global, societal, and contemporary issues of current interest such as leadership, entrepreneurship, ethics, cultural diversity, and professional licensure.

References Selected readings as appropriate

Goals This course prepares students to enter the workforce by addressing the some important non-technical aspects of a professional career

Prerequisite Junior or Senior standing

Class Topics The following topics will be investigated:

- Professional Code of Conduct
- Ethics
- Leadership
- Career planning and preparation
- Resumes, Interviewing and Job Search
- Additional related topics, based on the expertise of speakers selected that semester

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

1. Prepare a professional quality resume
2. Articulate clear professional goals
3. Demonstrate improved interviewing skills
4. Discuss issues of professionalism and ethics using the Profession Code of Conduct

Computer Usage Microsoft Office software

Laboratory none

Design Content none

Grading To be determined by instructor

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