

# **MET Assessment and Continuous Improvement Plan for the Associate Degree (AD) Program and Bachelors Degree (BS) Completion Program**

**(Revised and updated: September 27, 2007)**

**The significant constituencies of the program are:**

- Traditional students with an associate degree in engineering technology from a TAC/ABET accredited school.
- Non-traditional students with an associate degree in engineering technology from a TAC/ABET accredited school.
- Local Industry.
- TAC/ABET.
- Graduate schools.
- Local High Schools

The process used to establish and review the program objectives and outcomes, to evaluate assessment data, and to decide changes necessary for program improvement center around the continuous assessment of specific key courses within the MET curriculum. Each of these courses is assessed every time the course is offered utilizing the course assessment tools listed below. It should be noted that not all of the assessment tools are utilized each time the course is assessed. The MET faculty meet on a regular basis (2 or 3 times each academic term) to review course assessment data and make nay changes deemed necessary for program improvement. Examples of minutes from these meetings are provided within the MET assessment note book.

**Mechanical Engineering Technology faculty members responsible for major elements in the assessment process, and the timing and frequency of the activities:**

Each faculty member is responsible for conducting the assessment of his course and for keeping other faculty members well informed about assessment results and outcomes. Professor Gary Drigel is the coordinator of the AD and BS program and as such is responsible for making sure that individual faculty members maintain a robust effort toward continuous quality improvement for their course responsibilities related to that program. Every MET course taught within a specific term is assessed and these assessment and outcomes results are discussed and evaluated during faculty meetings that occur at least twice per term.

<b>Key Courses to be Assessed</b>	<b>Faculty Responsibility</b>
ENT 235	Earley
ENT 278	Ranatunga
ENT 252	Speckert
ENT 310*	Earley
ENT 314*	Earley

ENT 355*	Ranatunga
ENT 404*	Drigel
ENT 415*	Earley
ENT 416*	Ranatunga
ENT 316*	Drigel
ENT 497/498*	Hergert/Ranatunga

(\* is BS only courses)

Constituent Courses to be Assessed	Faculty Responsibility
ENT 135	Drigel
ENT 137	Speckert/Abatan
ENT 152	Speckert
ENT 151	Drigel
ENT 271	Earley
ENT 192	Seifried
ENT 272	Drigel
ENT 301*	Ranatunga/Narayanan
ENT 312*	Earley
ENT 333*	Narayanan

(\* is BS only courses)

### **MET Assessment Tools**

The assessment data comes from all or some of the following

Student Evaluations

Lab Assignments and Projects

Tests

Examinations

Employer Surveys

Graduate Surveys

### **MET Objectives**

These objectives were developed using input from several sources. These include: course objectives, industrial advisors, professor recommendations, faculty practical experience in both education and industry, advisory council, employer surveys, student feedback, continuous improvement plans and others.

The program produces graduates who:

Objective	Statement
i	Use applied skills to identify, evaluate, and solve complex technical problems. Specifically, MET graduates are able to analyze and design complex mechanical components and systems.
ii	Function effectively in team-oriented activities.
iii	Prepare well-written technical reports.
iv	Verbally communicate ideas.

v	Are able to effectively and efficiently manage engineering projects. (BS Only).
vi	Are able to set-up experimental testing procedures and selectively utilize data to reinforce engineering concepts.
vii	Apply math and physics principles to the solution of engineering technical problems.
viii	Use engineering computer software to facilitate engineering problem solving.
ix	Have a basic understanding of modern manufacturing methods used to facilitate the production of consumer products.
x	Demonstrate the knowledge of expected standards of ethical and professional conduct.
xi	In addition, our graduates will have the necessary fundamentals to pursue life-long learning.

**MET Outcomes Corresponding TAC/ABET Criteria 2**

Outcomes assessment occurs mainly at the course level. Each faculty member is responsible for conducting the assessment of his/her course and for keeping other faculty members well informed about assessment results and outcomes. In order to meet the MET objectives, each MET graduate will demonstrate the following attributes (outcomes) before graduation:

#	MET Outcome	a to k
1	Knowledge of modern engineering computer aided design methods and techniques used in the graphical representation of mechanical components.	a, g, k
2	Fundamental knowledge of engineering materials and how these materials are used in the design of machine components and systems.	a, b, d
3	The ability to apply creative technical skills to the analysis and design of mechanical components and systems.	a, b, d, e, g, i
4	Fundamental knowledge of modern manufacturing methods, especially in the areas of machining, quality control, and process control.	e, f, g, j, k
5	Knowledge of machine mechanisms analysis and synthesis that is essential to the design of machines and machine systems.	a, b, d, e, f
6	Knowledge of modern computer aided engineering analysis and design that is essential to the design of machines and machine systems.	a, b
7	Fundamental knowledge of fluid mechanics concepts used in the design of fluid and mechanical systems. (*BS degree only)	b, c, e, g
8	A basic working knowledge of heat energy transfer concepts essential to the analysis and design of machines and machine systems.	a, b, c, e, g
9	Written and verbal communication skills necessary for success in the modern industrial environment.	g, k

10	Mathematical and physical science skills necessary for the successful application of engineering concepts to design projects.	a, b
11	Effective team work skills	e., h
12	Project management (*BS degree only).	e, g, h, j, k
13	Fundamental knowledge of instrumentation used to measure parameters in the areas of: fluid mechanics, heat transfer, and mechanical vibrations. (*BS degree only)	a, b, d
14	Fundamental knowledge of effective data presentation and technical report writing.	e, f, h

### Matching Outcomes to Meet Objectives

Objective	Outcome
i	1, 2, 3, 5, 6, 7, 8, 10
ii	9, 11, 13, 14
iii	9, 14
iv	9
v	4, 12
vi	2, 10, 13, 14
vii	10
viii	1, 6
ix	4
x	11, 12
xi	2, 4, 7, 8, 9

### Courses Assessment Map

Key Courses to be Assessed	Constituent Courses
ENT 235	ENT 135
ENT 278	ENT 151, 271, 272
ENT 252	ENT 152
ENT 310*	ENT 271
ENT 314*	ENT 301*
ENT 355*	ENT 271, 272
ENT 404*	
ENT 415*	ENT 312*
ENT 416*	ENT 301*, 333*
ENT 316*	
ENT 497/498*	All ENT Courses

(\* is BS only courses)

**Assessment Tools for Each Outcome**

<b>Outcome</b>	<b>Courses Assessed</b>	<b>Assessment Tools</b>
<b>Outcome 1</b> - Knowledge of modern engineering computer aided design methods and techniques used in the graphical representation of mechanical components	ENT 235	Student Evaluations Lab Assignments and Projects Tests Examinations Employer Surveys Graduate Surveys
<b>Outcome 2</b> - Fundamental knowledge of engineering materials and how these materials are used in the design of machine components and systems.	ENT 278	Student Evaluations Lab Assignments and Projects Tests Examinations Employer Surveys Graduate Surveys
<b>Outcome 3</b> - The ability to apply creative technical skills to the analysis and design of mechanical components and systems.	ENT 278 ENT 314* ENT 415* ENT 416*	Student Evaluations Lab Assignments and Projects Tests Examinations Employer Surveys Graduate Surveys
<b>Outcome 4</b> - Fundamental knowledge of modern manufacturing methods, especially in the areas of machining, quality control, and process control.	ENT 252	Student Evaluations Lab Assignments and Projects Tests Examinations
<b>Outcome 5</b> - Knowledge of machine mechanisms analysis and synthesis that is essential to the design of machines and machine systems.	ENT 314*	Student Evaluations Lab Assignments and Projects Tests Examinations Employer Surveys Graduate Surveys
<b>Outcome 6</b> - Knowledge of modern computer aided engineering analysis and design that is essential to the design of machines and machine systems.	ENT 314* ENT 355*	Student Evaluations Lab Assignments and Projects Tests Examinations Employer Surveys Graduate Surveys
<b>Outcome 8</b> - A basic working knowledge of heat energy transfer concepts essential to the analysis and design of machines and machine systems.	ENT 415*	Student Evaluations Lab Assignments and Projects Tests Examinations Employer Surveys Graduate Surveys

<b>Outcome</b>	<b>Courses Assessed</b>	<b>Assessment Tools</b>
<b>Outcome 10</b> - Mathematical and physical science skills necessary for the successful application of engineering concepts to design projects.	ENT 416*	Student Evaluations Lab Assignments and Projects Tests Examinations Employer Surveys Graduate Surveys
<b>Outcome 11</b> - Effective team work skills	ENT 314* ENT 316* ENT 415* ENT 497/498*	Student Evaluations Lab Assignments and Projects Tests Examinations Employer Surveys Graduate Surveys
<b>Outcome 12</b> - Knowledge of Project management	ENT 316* ENT 497/498*	Student Evaluations Lab Assignments and Projects Tests Examinations Employer Surveys Graduate Surveys
<b>Outcome 13</b> - Fundamental knowledge of instrumentation used to measure parameters in fluid mechanics, heat transfer, and mechanical vibrations.	ENT 404* ENT 415* ENT 416*	Student Evaluations Lab Assignments and Projects Tests Examinations Employer Surveys Graduate Surveys
<b>Outcome 14</b> - Fundamental knowledge of effective data presentation and technical report writing.	ENT 404* ENT 415* ENT 416* ENT 497/498*	Student Evaluations Lab Assignments and Projects Tests Examinations Employer Surveys Graduate Surveys

(\* is BS only courses)

### **Continuous Improvement Process**

Mechanical Engineering Technology meet on a regular basis (2 to 3 times each academic term) to discuss issues regarding the MET AD and BS programs. At these meetings, the faculty also discuss assessment and continuous improvement. All assessment summaries affecting MET program outcomes are kept in the MET assessment notebooks and in Department assessment notes. The Department notebooks contain data from 3 primary sources: (1).Graduate surveys, (2) Employer surveys, and (3).Advisory council, accolades, letters, anecdotes, etc. These group of comprehensive notebooks are updated every semester and the assessment data are evaluated by the MET faculty. From this

evaluation, areas for improvement are identified. Action plans are developed which identify what, who, when, and how the improvement will happen. These action items are captured in minutes of the meetings and followed up on at subsequent meetings. Much of this work is driven by and includes our advisory council. Improvement results are also maintained in the MET and Department assessment notebooks. The program coordinators, department chair and assistant chair are responsible for maintaining the assessment notebooks.

### **Continuous Improvement Examples:**

- 1) When beginning the BS completion concentration in Mechanical, we used advisory council members (graduates, students, and employers) to review and assist in course syllabi development and textbook selection. This proved to be helpful to our faculty and invaluable to the quality and effectiveness of our program.
- 2) Since a majority of the MET Completion Program courses are new and have only been taught once or twice all are currently and continuously undergoing revisions /development in both their lecture and laboratory modules. During the academic year 2004-2005 the following courses had major revisions/additions especially in the associated laboratories of each: ENT 310, 314, 316, 355, 415, and 416. During the academic year 2006-2007 the following courses had major revisions/additions especially in the associated laboratories of each: ENT 312, 404 and 415. The scheduled MET laboratory tour will highlight many of these ongoing quality improvement efforts. For further details and information regarding the above continuous improvements efforts please contact the department chair or anyone of the MET faculty.
- 3) During the academic year 2004-2005 ENT 137 Introduction to Engineering Technology was added as a one credit hour required course within the MET curriculum.
- 4) During the academic year 2003-2004 Project Management was recommended as a necessary course by the Industrial Advisory Council. During the 2004-2005 academic year ENT 316 Project Management was developed, taught and approved by the faculty as a prerequisite to ENT 497 Senior Design. This prerequisite requirement has been fully implemented and has provided for a marked improvement in senior design project organization that continues into 2006 and beyond.
- 5) During the academic year 2004-2005 as a direct response to student concerns the MET faculty created a compact advisory packet that is now distributed to all new MET students to help guide them through their academic career. Please find examples of these materials within the tabbed section Advisor's Packet of the Mechanical Engineering Technology Assessment Data notebook.
- 6) During the academic year 2005-2006 additional necessary skills in GD&T were recommended by the Industrial Advisory Council and by a graduate employer. Action plans to add addition GD&T modules to the ENT 135 and ENT 252 courses are nearly complete.
- 7) During our spring 2005 advisory council meeting we were reviewing graduate survey data and noticed that we were rated lower than other areas in use of

computer and software. Although more research is needed, following our preliminary discussions with the advisory council we felt that this was due to our commitment to selected software that may or may not be the exact same software used by some companies. Our graduates on the council confirmed this but also said their education with us was effective preparation to learn other software tools.

- 8) Our assessment data are contained in notebooks available for review during the visit. Faculty meet to discuss these data relative to program objectives and outcomes. The results of these discussions (action items) are captured in minutes and plans. These data are also shared and discussed with the advisory council

The following table summarizes the two surveys used to assess objectives. Along with the accolades and informal feedback, we make judgments about how well we meet the MET Program Objectives.

## Continuous Improvement

Program educational Objectives	Assessment Tools and Selected Data Points			
	Graduate Surveys MET AS	Graduate Surveys MET BS	Employer Surveys	Advisory council, accolades, etc. Our assessment based on these indicators is
<i>Apply math and physics principles to the solution of engineering technical problems.</i>	4.52 out of 5.0	4.57 out of 5.0	3.88 out of 5.0	<b>Meets/Exceeds Criteria</b>
<i>Use applied skills to identify, evaluate, and solve complex technical problems.</i>	4.52 out of 5.0	4.60 out of 5.0	4.25 out of 5.0	<b>Meets/Exceeds Criteria</b>
<i>Use engineering computer software to facilitate engineering problem solving.</i>	4.19 out of 5.0	3.77 out of 5.0	4.44 out of 5.0	<b>Meets/Exceeds Criteria</b>
<i>Function effectively in team-oriented activities.</i>	4.19 out of 5.0	4.07 out of 5.0	4.56 out of 5.0	<b>Meets/Exceeds Criteria</b>
<i>Demonstrate the knowledge of expected standards of ethical and professional conduct.</i>	4.33 out of 5.0	4.21 out of 5.0	4.33 out of 5.0	<b>Meets/Exceeds Criteria</b>
<i>Verbally communicate ideas.</i>	4.24 out of 5.0	4.07 out of 5.0	4.22 out of 5.0	<b>Meets/Exceeds Criteria</b>
<i>Prepare well-written technical reports.</i>	4.10 out of 5.0	4.13 out of 5.0	4.11 out of 5.0	<b>Meets/Exceeds Criteria</b>
<i>In addition, our graduates will have the necessary fundamentals to pursue life-long learning.</i>	4.35 out of 5.0	4.27 out of 5.0	4.38 out of 5.0	<b>Meets/Exceeds Criteria</b>
<i>Are able to analyze and design complex mechanical components and systems.</i>	4.30 out of 5.0	4.33 out of 5.0	4.38 out of 5.0	<b>Meets/Exceeds Criteria</b>
<i>Are able to set-up experimental testing procedures and selectively utilize data to reinforce engineering concepts.</i>	4.20 out of 5.0	4.17 out of 5.0	3.75 out of 5	<b>Meets/Exceeds Criteria</b>
<i>Have a basic understanding of modern manufacturing methods used to facilitate the production of consumer products.</i>	4.50 out of 5.0	4.50 out of 5.0	4.25 out of 5	<b>Meets/Exceeds Criteria</b>
<i>Are able to effectively and efficiently manage engineering projects. (BS Only).</i>	NA	4.30 out of 5.0	4.40 out of 5	<b>Meets/Exceeds Criteria</b>

## Mechanical Engineering Technology Objectives Map to MET Outcomes and a to k

Objectives	Supporting MET Outcomes
<p>Use applied skills to identify, evaluate, and solve complex technical problems. Specifically, MET graduates are able to analyze and design complex mechanical components and systems.</p>	<p>1. Knowledge of modern engineering computer aided design methods and techniques used in the graphical representation of mechanical components. → a, g, k            2. Fundamental knowledge of engineering materials and how these materials are used in the design of machine components and systems. → a, b, d            3. The ability to apply creative technical skills to the analysis and design of mechanical components and systems. → a, b, d, e, g, i            5. Knowledge of machine mechanisms analysis and synthesis that is essential to the design of machines and machine systems. → a, b, d, e, f            6. Knowledge of modern computer aided engineering analysis and design that is essential to the design of machines and machine systems. → a, b            7. Fundamental knowledge of fluid mechanics concepts used in the design of fluid and mechanical systems. → b, c, e, g            8. A basic working knowledge of heat energy transfer concepts essential to the analysis and design of machines and machine systems. → a, b, c, e, g            10. Mathematical and physical science skills necessary for the successful application of engineering concepts to design projects. → a, b            11. Effective team work skills → e., h</p>
<p>Function effectively in team-oriented activities.</p>	<p>9. Written and verbal communication skills necessary for success in the modern            11. Effective team work skills → e., h            13. Fundamental knowledge of instrumentation used to measure parameters in fluid mechanics, heat transfer, and mechanical vibrations. → a, b, d            14. Fundamental knowledge of effective data presentation and technical report writing. → e, f, h</p>
<p>Prepare well-written technical reports.</p>	<p>9. Written and verbal communication skills necessary for success in the modern industrial environment. → g, k            14. Fundamental knowledge of effective data presentation and technical report writing. → e, f, h</p>
<p>Verbally communicate ideas.</p>	<p>9. Written and verbal communication skills necessary for success in the modern industrial environment. → g, k</p>
<p>Are able to effectively and efficiently manage engineering projects. (BS Only)</p>	<p>4. Fundamental knowledge of modern manufacturing methods, especially in the areas of machining, quality control, and process control. → e, f, g, j, k            12. Knowledge of project management → e, g, h, j, k</p>

## Mechanical Engineering Technology Objectives Map to MET Outcomes and a to k (cont)

Objectives	Supporting MET Outcomes
<p><b>Are able to set-up experimental testing procedures and selectively utilize data to reinforce engineering concepts.</b></p>	<p>2. Fundamental knowledge of engineering materials and how these materials are used in the design of machine components and systems. → <b>a, b, d</b>            10. Mathematical and physical science skills necessary for the successful application of engineering concepts to design projects. → <b>a, b</b>            13. Fundamental knowledge of instrumentation used to measure parameters in fluid mechanics, heat transfer, and mechanical vibrations. → <b>a, b, d</b>            14. Fundamental knowledge of effective data presentation and technical report writing. → <b>e, f, h</b></p>
<p><b>Apply math and physics principles to the solution of engineering technical problems.</b></p>	<p>10. Mathematical and physical science skills necessary for the successful application of engineering concepts to design projects. → <b>a, b</b></p>
<p><b>Use engineering computer software to facilitate engineering problem solving.</b></p>	<p>1. Knowledge of modern engineering computer aided design methods and techniques used in the graphical representation of mechanical components. → <b>a, g, k</b>            6. Knowledge of modern computer aided engineering analysis and design that is essential to the design of machines and machine systems. → <b>a, b</b></p>
<p><b>Have a basic understanding of modern manufacturing methods used to facilitate the production of consumer products.</b></p>	<p>4. Fundamental knowledge of modern manufacturing methods, especially in the areas of machining, quality control, and process control. → <b>e, f, g, j, k</b></p>
<p><b>Demonstrate the knowledge of expected standards of ethical and professional conduct.</b></p>	<p>11. Effective team work skills → <b>e, h</b>            12. Knowledge of project management → <b>e, g, h, j, k</b></p>
<p><b>Our graduates will have the necessary fundamentals to pursue life-long learning.</b></p>	<p>2. Fundamental knowledge of engineering materials and how these materials are used in the design of machine components and systems. → <b>a, b, d</b>            4. Fundamental knowledge of modern manufacturing methods, especially in the areas of machining, quality control, and process control. → <b>e, f, g, j, k</b>            7. Fundamental knowledge of fluid mechanics concepts used in the design of fluid and mechanical systems. → <b>b, c, e, g</b>            8. A basic working knowledge of heat energy transfer concepts essential to the analysis and design of machines and machine systems. → <b>a, b, c, e, g</b>            9. Written and verbal communication skills necessary for success in the modern industrial environment. → <b>g, k</b></p>

## TAC/ABET a-k Mapped to Mechanical Engineering Technology Outcomes

TAC/ABET Criteria An engineering technology program must demonstrate that graduates have:	MET Outcomes
<p><b>(a)</b> an appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines,</p>	<p>1. Knowledge of modern engineering computer aided design methods and techniques used in the graphical representation of mechanical components. → a, g, k</p> <p>2. Fundamental knowledge of engineering materials and how these materials are used in the design of machine components and systems. → a, b, c, d</p> <p>3. The ability to apply creative technical skills to the analysis and design of mechanical components and systems. → a, b, d, e, g, h, i</p> <p>5. Knowledge of machine mechanisms analysis and synthesis that is essential to the design of machines and machine systems. → a, b, d, e, f</p> <p>6. Knowledge of modern computer aided engineering analysis and design that is essential to the design of machines and machine systems. → a, b</p> <p>8. A basic working knowledge of heat energy transfer concepts essential to the analysis and design of machines and machine systems. → a, b, c, e, g</p> <p>10. Mathematical and physical science skills necessary for the successful application of engineering concepts to design projects. → a, b</p> <p>13. Fundamental knowledge of instrumentation used to measure parameters in fluid mechanics, heat transfer, and mechanical vibrations. → a, b, d</p>
<p><b>(b)</b> an ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology,</p>	<p>2. Fundamental knowledge of engineering materials and how these materials are used in the design of machine components and systems. → a, b, c, d</p> <p>3. The ability to apply creative technical skills to the analysis and design of mechanical components and systems. → a, b, d, e, g, h, i</p> <p>5. Knowledge of machine mechanisms analysis and synthesis that is essential to the design of machines and machine systems. → a, b, d, e, f</p> <p>6. Knowledge of modern computer aided engineering analysis and design that is essential to the design of machines and machine systems. → a, b</p> <p>7. Fundamental knowledge of fluid mechanics concepts used in the design of fluid and mechanical systems. → b, c, e, g</p> <p>8. A basic working knowledge of heat energy transfer concepts essential to the analysis and design of machines and machine systems. → a, b, c, e, g</p> <p>10. Mathematical and physical science skills necessary for the successful application of engineering concepts to design projects. → a, b</p> <p>13. Fundamental knowledge of instrumentation used to measure parameters in fluid mechanics, heat transfer, and mechanical vibrations. → a, b, d</p>

## TAC/ABET a-k Mapped to Mechanical Engineering Technology Outcomes (cont)

TAC/ABET Criteria An engineering technology program must demonstrate that graduates have:	MET Outcomes
(c) an ability to conduct, analyze and interpret experiments and apply experimental results to improve processes,	7. Fundamental knowledge of fluid mechanics concepts used in the design of fluid and mechanical systems. → b, c, e, g 8. A basic working knowledge of heat energy transfer concepts essential to the analysis and design of machines and machine systems. → a, b, c, e, g
(d) an ability to apply creativity in the design of systems, components or processes appropriate to program objectives,	2. Fundamental knowledge of engineering materials and how these materials are used in the design of machine components and systems. a, b, c, d 5. Knowledge of machine mechanisms analysis and synthesis that is essential to the design of machines and machine systems. → a, b, d, e, f 13. Fundamental knowledge of instrumentation used to measure parameters in fluid mechanics, heat transfer, and mechanical vibrations. → a, b, d
(e) an ability to function effectively on teams,	3. The ability to apply creative technical skills to the analysis and design of mechanical components and systems. → a, b, d, e, g, h, i 4. Fundamental knowledge of modern manufacturing methods, especially in the areas of machining, quality control, and process control. → c, e, f, g, j, k 5. Knowledge of machine mechanisms analysis and synthesis that is essential to the design of machines and machine systems. → a, b, d, e, f 7. Fundamental knowledge of fluid mechanics concepts used in the design of fluid and mechanical systems. → b, c, e, g 8. A basic working knowledge of heat energy transfer concepts essential to the analysis and design of machines and machine systems. → a, b, c, e, g 11. Effective team work skills → e., h 12. Knowledge of project management → e, g, h, j, k 14. Fundamental knowledge of effective data presentation and technical report writing. → e, f, h
(f) an ability to identify, analyze and solve technical problems,	4. Fundamental knowledge of modern manufacturing methods, especially in the areas of machining, quality control, and process control. → c, e, f, g, j, k 5. Knowledge of machine mechanisms analysis and synthesis that is essential to the design of machines and machine systems. → a, b, d, e, f 14. Fundamental knowledge of effective data presentation and technical report writing. → e, f, h

## TAC/ABET a-k Mapped to Mechanical Engineering Technology Outcomes (cont)

TAC/ABET Criteria An engineering technology program must demonstrate that graduates have:	MET Outcomes
(g) an ability to communicate effectively,	1. Knowledge of modern engineering computer aided design methods and techniques used in the graphical representation of mechanical components. → a, g, k 3. The ability to apply creative technical skills to the analysis and design of mechanical components and systems. → a, b, d, e, g, h, i 4. Fundamental knowledge of modern manufacturing methods, especially in the areas of machining, quality control, and process control. → c, e, f, g, j, k 7. Fundamental knowledge of fluid mechanics concepts used in the design of fluid and mechanical systems. → b, c, e, g 8. A basic working knowledge of heat energy transfer concepts essential to the analysis and design of machines and machine systems. → a, b, c, e, g 9. Written and verbal communication skills necessary for success in the modern industrial environment. → g, k 12. Knowledge of project management → e, g, h, j, k
(h) a recognition of the need for, and an ability to engage in lifelong learning,	11. Effective team work skills → e., h 12. Knowledge of project management → e, g, h, j, k 14. Fundamental knowledge of effective data presentation and technical report writing. → e, f, h
(i) an ability to understand professional, ethical and social responsibilities,	3. The ability to apply creative technical skills to the analysis and design of mechanical components and systems. → a, b, d, e, g, h, i
(j) a respect for diversity and a knowledge of contemporary professional, societal and global issues, and	4. Fundamental knowledge of modern manufacturing methods, especially in the areas of machining, quality control, and process control. → c, e, f, g, j, k 12. Knowledge of project management → e, g, h, j, k
(k) a commitment to quality, timeliness, and continuous improvement	1. Knowledge of modern engineering computer aided design methods and techniques used in the graphical representation of mechanical components. → a, g, k 4. Fundamental knowledge of modern manufacturing methods, especially in the areas of machining, quality control, and process control. → c, e, f, g, j, k 9. Written and verbal communication skills necessary for success in the modern industrial environment. → g, k 12. Knowledge of project management → e, g, h, j, k

## Mechanical Engineering Technology Program Rubrics for Outcomes 1 – 14

(\* indicates BS only courses)

	Beginning (1)	Developing (3)	Accomplished (5)
MET Outcome #1	Knowledge of modern engineering computer aided design methods and techniques used in the graphical representation of mechanical components.(TAC ABET Outcomes a, g, k)		
ENT 235	Able to construct basic 3D models.	Able to construct 3D models and analyze outputs and stresses.	Able to do animation including adding constraints on 3D models.
MET Outcome #2	Fundamental knowledge of engineering materials and how these materials are used in the design of machine components and systems. (TAC ABET outcome a, b, c, d).		
ENT 278	Able to identify types and classifications of materials.	Able to identify prospective materials for selective applications and analysis.	Integrates material selection into the design process including cost effectiveness.
MET Outcome #3	The ability to apply creative technical skills to the analysis and design of mechanical components and systems. (TAC ABET outcome a, b, d, e, g, h, i)		
ENT 278	Integrates material selection, manufacturing and assemble, ease of use, and reliability into the design process including cost effectiveness.	Integrates material selection, manufacturing and assemble, ease of use, and reliability into the design process including cost effectiveness.	Integrates material selection, manufacturing and assemble, ease of use, and reliability into the design process including cost effectiveness.
ENT 314*	Able to construct basic mechanism models.	Able to combine series of simple mechanisms into more complex mechanisms.	Construct and analyze the design of mechanisms including economic viability.
ENT 415*	Able to perform basic heat transfer calculations.	Able to perform heat transfer calculations and analysis of systems.	Able to apply heat transfer analysis to system design.
ENT 416*	Able to perform basic vibration calculations.	Able to perform vibration calculations and analysis of systems.	Able to apply vibration analysis to system design.

## Mechanical Engineering Technology Program Rubrics for Outcomes 1 – 14 (cont)

(\* indicates BS only courses)

MET Outcome #4			
Fundamental knowledge of modern manufacturing methods, especially in the areas of machining, quality control, and process control. (TAC ABET Outcome c, e, f, g, h, j, k)			
ENT 252	Demonstrates a basic understanding of modern manufacturing concepts including speeds and feed, quality control, and basic CNC topics.	Able to utilize knowledge of modern CNC manufacturing processes to facilitate production of basic products. Also able to utilize basic quality control tools.	Able to utilize knowledge of modern CNC, CAD/CAM, and related manufacturing processes and quality control techniques to facilitate production of products.
MET Outcome #5			
Knowledge of machine mechanisms analysis and synthesis that is essential to the design of machines and machine systems. (TAC ABET Outcome a, b, d, e, f)			
ENT 314*	Able to construct basic mechanism models.	Able to combine series of simple mechanisms into more complex mechanisms and machines.	Construct and analyze the design of mechanisms and machines including economic viability.
MET Outcome #6			
Knowledge of modern computer aided engineering analysis and design that is essential to the design of machines and machine systems. (TAC/ABET Outcome a, b)			
ENT 314*	Able to construct basic mechanism models.	Able to combine series of simple mechanisms into more complex mechanisms.	Construct and analyze the design of mechanisms including economic viability.
ENT 355*	Able to import and set up basic finite element models.	Able to use finite element analysis to evaluate basic designs.	Able to use finite element analysis to design complex mechanisms and evaluate potential problems in design.
MET Outcome #7			
Fundamental knowledge of fluid mechanics concepts used in the design of fluid and mechanical systems. (*BS degree only) (TAC/ABET Outcome b, c, e, g)			
ENT 310*	Able to understand basic fluid statics and to analyze simple fluid mechanics problems.	Able to apply fluid mechanics in the analysis mechanical systems.	Able to apply fluid mechanics in the analysis and design of complex mechanical systems.

## Mechanical Engineering Technology Program Rubrics for Outcomes 1 – 14 (cont)

(\* indicates BS only courses)

MET Outcome #8	A basic working knowledge of energy transfer concepts essential to the analysis and design of machines and machine systems. (TAC/ABET Outcome a, b, c, e, g)		
ENT 415*	Able to perform basic heat transfer calculations.	Able to perform heat transfer calculations and analysis of systems.	Able to apply heat transfer analysis to system design.
MET Outcome #9	Written and verbal communication skills necessary for success in the modern industrial environment. (TAC/ABET Outcome g, k)		
ENT 497/498*	Able to write and verbally communicate the results of a mechanical design or problem solution to a group peers.	Able to write and verbally communicate the results of a mechanical design or problem solution to group of faculty and industrial advisors.	Able to write and verbally communicate the results of a mechanical design or problem solution to group of faculty and industrial advisors resulting in financial support of a project.
MET Outcome #10	Mathematical and physical science skills necessary for the successful application of engineering concepts to design projects.(TAC/ABET Outcomes a, b)		
ENT 310*	Able to understand basic fluid statics and to analyze simple fluid mechanics problems.	Able to apply fluid mechanics in the analysis mechanical systems.	Able to apply fluid mechanics in the analysis and design of complex mechanical systems.
ENT 416*	Able to perform basic vibration calculations.	Able to perform vibration calculations and analysis of systems.	Able to apply vibration analysis to system design.
MET Outcome #11	Effective team work skills. (TAC/ABET Outcome e, h)		
ENT 314*	Able to construct basic mechanism models working with a partner	Able to combine series of simple mechanisms into more complex mechanisms working with a design team.	Construct and analyze the design of mechanisms including economic viability in a multifunctional team.
ENT 316*	Has a basic understanding of team work used in project management.	Able to function in a team based environment and manage simple multi functional projects.	Able to function in a team based organization and manage complex projects while providing feedback for continuous improvement.

## Mechanical Engineering Technology Program Rubrics for Outcomes 1 – 14 (cont)

(\* indicates BS only courses)

MET Outcome #11 (cont)	Effective team work skills. (TAC/ABET Outcome e, h)	MET Outcome #11	Effective team work skills. (TAC/ABET Outcome e, h)
ENT 415*	Able to perform basic heat transfer calculations. working with a partner	Able to perform heat transfer calculations and analysis of systems. working with a design team.	Able to apply heat transfer analysis to system design in a multifunctional team.
MET Outcome #12	Project management (*BS degree only). (TAC/ABET Outcome e, g, h, j, k)		
ENT 316*	Has a basic understanding of the tool used in project management.	Able to apply the tools of project management to manage simple projects.	Able to use the tools of project management to manage complex projects and provide feedback for continuous improvement.
MET Outcome #13	Fundamental knowledge of instrumentation used to measure parameters in the areas of: fluid mechanics, heat transfer, and mechanical vibrations. (*BS degree only)(TAC/ABET Outcome a, b, d)		
ENT 310*	Able to understand basic instruments used to measure parameters in fluid statics problems.	Able to determine and apply the necessary measurement techniques in the analysis fluid mechanics systems.	Able to determine and apply the necessary measurement techniques in the analysis and design of complex fluid systems.
ENT 404*	Able to understand basic instruments used to measure parameters in mechanical engineering technology.	Able to determine and apply the necessary measurement techniques in the analysis mechanical systems.	Able to determine and apply the necessary measurement techniques in the analysis and design of complex mechanical systems.
ENT 415*	Able to understand basic instruments used to measure parameters in heat transfer problems.	Able to determine and apply the necessary measurement techniques in the analysis in heat transfer systems.	Able to determine and apply the necessary measurement techniques in the analysis and design of complex heat transfer systems.
ENT 416*	Able to understand basic instruments used to measure parameters in mechanical vibration problems.	Able to determine and apply the necessary measurement techniques in the analysis vibration in mechanical systems.	Able to determine and apply the necessary measurement techniques for analysis and design of complex systems with respect to mechanical vibration.

**PROGRAM CRITERIA 8 FOR  
MECHANICAL ENGINEERING TECHNOLOGY  
AND SIMILARLY NAMED PROGRAMS**  
Lead Society: American Society of Mechanical Engineers

**Applicability**

These program criteria apply to engineering technology programs that include mechanical and similar modifiers in their titles.

**Objective**

An accreditable program in Mechanical Engineering Technology will prepare graduates with knowledge, problem solving ability, and hands-on skills to enter careers in the design, installation, manufacturing, testing, evaluation, technical sales, or maintenance of mechanical systems. Level and scope of career preparation will depend on the degree level and specific program orientation. Graduates of associate degree programs typically have strengths in specifying, installing, fabricating, testing, documenting, operating, selling, or maintaining basic mechanical systems, whereas baccalaureate degree graduates typically have strengths in the analysis, applied design, development, implementation, or oversight of more advanced mechanical systems and processes.

**MET Objectives**

TAC/ABET Criteria (Objectives)	MET Program Objectives	Met Program
<p>Graduates of Associate Degree programs typically have strengths in specifying, installing, fabricating, testing, documenting, operating, selling, or maintaining basic mechanical systems.</p>	<ul style="list-style-type: none"> <li>• Use applied skills to identify, evaluate, and solve complex technical problems. Specifically, MET graduates are able to analyze and design complex mechanical components and systems.</li> <li>• Function effectively in team-oriented activities.</li> <li>• Prepare well-written technical reports.</li> <li>• Verbally communicate ideas.</li> <li>• Are able to set-up experimental testing procedures and selectively utilize data to reinforce engineering concepts.</li> <li>• Apply math and physics principles to the solution of engineering technical problems.</li> <li>• Use engineering computer software to facilitate engineering problem solving.</li> <li>• Have a basic understanding of modern manufacturing methods used to facilitate the production of consumer products.</li> <li>• Demonstrate the knowledge of expected standards of ethical and professional conduct.</li> <li>• Our graduates will have the necessary fundamentals to pursue life-long learning.</li> </ul>	<p>Of the TAC/ABET criteria for MET graduates, Miami's program is particularly effective in meeting all of the strengths listed.</p>
<p>Baccalaureate Degree graduates typically have strengths in the analysis, applied design, development, implementation, or oversight of more advanced mechanical systems and processes.</p>	<p>BS Graduates meet all associate degree objectives + are able to effectively and efficiently manage engineering projects. (BS Only)</p>	

## Outcomes

Each program must demonstrate that the technical and scientific areas of expertise developed by graduates are appropriate to the technical orientation and goals of that program.

### MET Outcomes

**Associate Degree programs must demonstrate that graduates can apply the following principles to the specification, installation, fabrication, test, operation, maintenance, sales, maintenance, or documentation of basic mechanical systems:**

TAC/ABET Outcome	MET Outcomes	MET Courses
a. Technical expertise in a minimum of three subject areas chosen from engineering materials, applied mechanics, applied fluid sciences, applied thermal sciences, and fundamentals of electricity.	<ul style="list-style-type: none"> <li>• Fundamental knowledge of engineering materials and how these materials are used in the design of machine components and systems.</li> <li>• The ability to apply creative technical skills to the analysis and design of mechanical components and systems.</li> <li>• Knowledge of modern computer aided engineering analysis and design that is essential to the design of machines and machine systems.</li> <li>• A basic working knowledge of energy transfer concepts essential to the analysis and design of machines and machine systems.</li> </ul>	ENT 151 Engineering Materials ENT 135 Computer Aided Drafting ENT 235 Computer Aided Design ENT 271-272-278 Mechanics I,II, and III ENT 192 Circuit Analysis I
b. Technical expertise in manufacturing processes, mechanical design, and computer aided engineering graphics with added technical depth in at least one of these areas.	<ul style="list-style-type: none"> <li>• Fundamental knowledge of modern manufacturing methods, especially in the areas of machining, quality control, and process control.</li> <li>• Knowledge of modern engineering computer aided design methods and techniques used in the graphical representation of mechanical components.</li> </ul>	ENT 152 & 252 Computer Aided Mfg I & II ENT 135 Computer Aided Drafting ENT 235 Computer Aided Design
c. Expertise in applied physics having an emphasis in applied mechanics plus inorganic chemistry, or, if program objectives do not require chemistry, added technical topics in physics appropriate to the program objectives.	<ul style="list-style-type: none"> <li>• Mathematical and physical science skills necessary for the successful application of engineering concepts to design projects.</li> <li>• A basic working knowledge of energy transfer concepts essential to the analysis and design of machines and machine systems.</li> </ul>	MTH 125 Pre-Calculus MTH 151 Calculus ENT 271-272-278 Mechanics I, II, and III

## Outcomes

<b>Baccalaureate Degree programs must demonstrate that graduates can apply the following concepts to the analysis, development, implementation, or oversight of mechanical systems and processes:</b>		
TAC/ABET Outcome	MET Outcomes	MET Courses
<p>a. Technical expertise in engineering materials, statics, dynamics, strength of materials, fluid power or fluid mechanics, thermodynamics, and either electrical power or electronics.</p>	<ul style="list-style-type: none"> <li>• Knowledge of modern engineering computer aided design methods and techniques used in the graphical representation of mechanical components.</li> <li>• Fundamental knowledge of engineering materials and how these materials are used in the design of machine components and systems.</li> <li>• The ability to apply creative technical skills to the analysis and design of mechanical components and systems.</li> <li>• Fundamental knowledge of modern manufacturing methods, especially in the areas of machining, quality control, and process control.</li> <li>• Knowledge of machine mechanisms analysis and synthesis that is essential to the design of machines and machine systems.</li> <li>• Knowledge of modern computer aided engineering analysis and design that is essential to the design of machines and machine systems.</li> <li>• Fundamental knowledge of fluid mechanics concepts used in the design of fluid and mechanical systems. (*BS degree only)</li> <li>• A basic working knowledge of energy transfer concepts essential to the analysis and design of machines and machine systems.</li> <li>• Fundamental knowledge of instrumentation used to measure parameters in the areas of: fluid mechanics, heat transfer, and mechanical vibrations. (*BS degree only)</li> </ul>	<p>ENT 312 Thermodynamics            ENT 415 Heat Transfer            ENT 314 Mechanisms            ENT 355 Finite Element            ENT 404 Experimentation Techniques            ENT 310 Fluid Mechanics            ENT 416 Topics in Mechanical Vibrations            ENT 479-498 Senior Design</p>
<p>b. Technical expertise having added technical depth in a minimum of three subject areas chosen from: manufacturing processes, mechanical design, computer aided engineering graphics, engineering materials, solid mechanics, fluids, thermal sciences, electro mechanical devices and controls, and industrial operations.</p>	<p>Fundamental knowledge of instrumentation used to measure parameters in the areas of: fluid mechanics, heat transfer, and mechanical vibrations. (*BS degree only)</p>	<p>ENT 312 Thermodynamics            ENT 415 Heat Transfer            ENT 314 Mechanisms            ENT 355 Finite Element            ENT 404 Experimentation Techniques            ENT 310 Fluid Mechanics            ENT 416 Topics in Mechanical Vibrations            ENT 479-498 Senior Design</p>
<p>c. Expertise in applied physics having an emphasis in applied mechanics, plus added technical topics in physics and inorganic chemistry principles appropriate to the program objectives.</p>	<p>Mathematical and physical science skills necessary for the successful application of engineering concepts to design projects.</p>	<p>MTH 251 Calculus II            STA 301 Statistics            MTH 231 Discrete Math            CHM 141 (or 137)/ or CHM 144 with lab.</p>

## Department of Engineering Technology Mapped to Mechanical Objectives

Mechanical Objectives	Departmental Objectives
Apply math and physics principles to the solution of engineering technical problems.	Apply math and physics principles to the solution of engineering technical problems.
Use applied skills to identify, evaluate, and solve complex technical problems.	Use applied skills to identify, evaluate, and solve complex technical problems.
Use engineering computer software to facilitate engineering problem solving.	Use engineering computer software to facilitate engineering problem solving.
Function effectively in team-oriented activities.	Function effectively in team-oriented activities.
Demonstrate the knowledge of expected standards of ethical and professional conduct	Demonstrate the knowledge of expected standards of ethical and professional conduct.
Verbally communicate ideas	Verbally communicate ideas.
Prepare well-written technical reports.	Prepare well-written technical reports.
Our graduates will have the necessary fundamentals to pursue life-long learning	In addition, our graduates will have the necessary fundamentals to pursue life-long learning.
Are able to analyze and design complex mechanical components and systems.	
Are able to set-up experimental testing procedures and selectively utilize data to reinforce engineering concepts.	
Have a basic understanding of modern manufacturing methods used to facilitate the production of consumer products.	
Are able to effectively and efficiently manage engineering projects (BS Only).	