

Assessment Rubrics

Assessment Rubric for ME312 – Thermodynamics II

Method: One project and the final exam.

Outcomes Assessed:

- a. an ability to apply knowledge of math, science, and engineering
- e. an ability to identify, formulate, and solve engineering problems
- g. an ability to communicate effectively (g1: written; g2: oral)
- h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- j. a knowledge of contemporary issues
- k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Performance	Exceeds expectation (5)	Meets expectation (3)	Does not meet expectations (1)
1. Problem setup [a, e]	Problems are translated into <i>proper mathematical</i> forms which are ready to be solved.	Problems are translated into mathematical forms which are ready to be solved <i>with minor errors</i>	<i>Unable to</i> translate problem into proper mathematical forms
2. Mathematical modeling [a]	Combines mathematics and/or scientific principles to <i>formulate models</i> of thermodynamics;	<i>Chooses, rather than develops,</i> a mathematical model and/or scientific principle that applies to thermodynamics	<i>Does not understand</i> the connection between a mathematical model and/or scientific principles applied to thermodynamics
3. Engineering problem-solving [e]	<i>Executes calculation correctly</i> by hand and/or using math/engineering software	<i>Minor errors</i> in calculations by hand or using math/engineering software	Calculations <i>not performed or performed totally incorrectly</i> by hand or does not know how to use math/engineering software
4. Global, economic, environmental, and societal impacts [h]	Design project <i>includes</i> content/information that shows <i>good understanding</i> of impact in a global, economic, environmental, and social context.	Design project <i>includes</i> content/information that shows <i>adequate understanding</i> of impact in a global, economic, environmental, and social context.	Design project does not include or <i>includes</i> content/information that shows <i>little or no understanding</i> of the impact in a global, economic, environmental, and social context.

5. Project report and organization [g1]	Materials are well organized and easy to follow, correct grammar and spelling	Materials are generally organized but some paragraphs are not well developed and thought out, some minor typos and incorrect grammar	Poor organization, material is poorly written with no sub-headings, numerous typos and incorrect grammar
6. Project presentation [g2]	Clear, effective, and well organized presentation	generally effective presentation with some difficulty explaining key points	Poor presentation, difficult to follow and understand
7. Contemporary issues [j]	Design project <i>includes</i> content/information that shows a <i>good understanding</i> of contemporary issues	Design project <i>includes</i> content/information that shows an <i>understanding</i> of contemporary issues	Design project <i>does not include or includes</i> content/information that shows <i>little or no understanding</i> of contemporary issues
8. Use of modern engineering tools [k]	Computer and software are extensively used in the course	Computer and software are somewhat utilized, effort was put into learning new software	Computer and software are not utilized, no attempt was made at learning new software

Assessment Rubrics for ME 356 – Dynamical Systems

Method: One project and the final exam.

Outcomes Assessed:

- a. an ability to apply knowledge of mathematics (through multivariate calculus and differential equations), science, and engineering, familiar with statistics and linear algebra.
- e. an ability to identify, formulate, and solve engineering problems
- k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Performance	Exceeds expectation (5)	Meets expectation (3)	Does not meet expectation (1)
1. Knowledge and application [a]	Applies the appropriate knowledge and concepts to the problem with accuracy and proficiency; shows precise understanding of these knowledge and concepts.	Applies the relevant knowledge and concept to the problem, possibly in a roundabout way; understands the major points of the knowledge, with possible misunderstanding or failure to recall minor points;	Fails to apply relevant knowledge and concepts to the problem; misunderstands or fails to recall critical points.
2. Problem identification [e]	The question to be solved is accurately identified.	The question to be solved is identified largely correctly with possible minor mistakes.	The question to be solved is identified substantially wrong.
3. Problem setup [e]	The problem is translated in a mathematical or other standard form readily amenable for solution.	The problem is translated in a mathematical or other standard form that may contain minor mistakes or not easily solved.	Unable to translate to an appropriate mathematical or other standard form.
4. Solution [e]	The problem is solved accurately in terms of mathematical manipulation and numerical calculation.	The solution contains some minor math or numerical errors.	Major problem in solving the problem.
5. Use of modern engineering software [k]	Demonstrates knowledge and application of modern engineering software through accurate development and interpretation of computer programs to solve problems.	Demonstrates awareness of modern engineering software through mostly correct development and interpretation of computer programs to solve problems, but may contain minor mistakes or syntax errors.	Unable to use modern engineering software to develop or interpret computer programs to solve problems.

Assessment form for ME 380 – Design of machine elements

Method: One project and the final exam

Outcomes Assessed:

- a. an ability to apply knowledge of mathematics, science, and engineering; familiarity with statistics and linear algebra.
- c. an ability to design a system, component, or process (both thermal and mechanical) to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- e. an ability to identify, formulate, and solve engineering problems
- g. an ability to communicate effectively (g1: written)

Performance	Exceeds expectation (5)	Meets expectation (3)	Does not meet expectation (1)
1. Knowledge and application [a]	Applies the appropriate knowledge and concepts to the problem with accuracy and proficiency; shows precise understanding of these knowledge and concepts.	Applies the relevant knowledge and concept to the problem, possibly in a roundabout way; understands the major points of the knowledge, with possible misunderstanding or failure to recall minor points;	Fails to apply relevant knowledge and concepts to the problem; misunderstands or fails to recall critical points.
2. Problem identification [e]	Problem is accurately identified with physical and mechanical models.	Problem is interpreted largely correctly with possible minor mistakes.	The interpretation is substantially wrong.
3. Problem formulation [e]	The problem is translated in a mathematical or other standard form readily amenable for solution.	The problem is translated in a mathematical or other standard form that may contain minor mistakes or not easily solved.	Unable to translate to an appropriate mathematical or other standard form.
4. Solution [e]	The problem is solved properly in terms of mathematical manipulation and numerical calculation.	The solution contains some minor math or numerical errors.	Major problem in solving the problem.

Performance	Exceeds expectation (5)	Meets expectation (3)	Does not meet expectation (1)
5. Design strategy [c]	Uses sound design strategy, readily uses alternative methods when necessary	Uses valid design strategy, albeit maybe roundabout and lacks alternatives	Fails to use a valid design strategy, haphazard approach
6. Optimization [c]	Suggests several potential structures or solutions, chooses better design or an appropriate discussion of pros and cons of the alternatives	Suggests several potential structures or solutions. However, fails to choose the optimal design or misses some important aspects in discussing the pros and cons of different alternatives	Fails to consider important alternatives or shows complete lack of understanding pros and cons of alternatives
7. Constraints [c]	Appropriately considers constraints such as manufacturability, economics, safety, and environment.	Considers some of the constraints, but fails to consider or misinterprets some important constraints.	Fails to consider or misinterprets key constraints.
8. Documentation: contents and organization [c,g1]	Report well organized, appropriately sectioned, uses diagram when appropriate, important issues clearly stated	Report reasonably well documented. May lack some minor aspects.	Report not well organized, lack key aspects.
9. Documentation: language and format [g1]	Almost no grammar or spelling errors, uses good professional style, neat and visually appealing	Possess many of the characteristics of desirable features, but lacks a few others	Fails to write in a professional style

Assessment Rubrics for ME 380L – Stress Laboratory

Method: Lab reports and instructor observation during Lab sessions

Outcome Assessed:

- b.** an ability to design and conduct experiments, as well as to analyze and interpret data
- d.** an ability to function on multi-disciplinary teams
- k.** an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Performance	Exceeds expectation (5)	Meets expectation (3)	Does not meet expectation (1)
1. Design and Realization of Experiment [b, k]	Carefully plans and sets objectives as well as strategies, selects relevant equipment to the experiment, develops setup diagrams of equipment connections and wiring.	Plans and sets objectives, but strategies are not clearly stated, needs guidance to select relevant equipment to the experiment and to develop equipment connection and wiring diagrams.	Unable to plan and set objectives, incapable of selecting relevant equipment to conduct the experiment, equipment connection and wiring diagrams are unrecognizable.
2. Teamwork [d]	Actively engages and cooperates with other group members in an effective manner.	Cooperates with other group members in a reasonable manner.	Distracts or discourages other group members from conducting the experiment.
3. Conducting Experiment [b, k]	Does proper calibration of equipment, carefully examines equipment moving parts, and ensures smooth operation and process.	Calibrates equipment, examines equipment moving parts, and operates the equipment with minor error.	Unable to calibrate appropriate equipment, and equipment operation is substantially wrong.
4. Laboratory Safety Rules [b]	Respectfully and carefully observes safety rules and procedures	Observes safety rules and procedures with minor deviation.	Disregards safety rules and procedures.
5. Data Collection [b]	Plans data collection to achieve experimental objectives, and conducts an orderly and a complete data collection.	Plans data collection to achieve experimental objectives, and collects complete data with minor error.	Does not know how to plan data collection to achieve experimental goals; data collected is incomplete and contain errors.

6. Data Analysis [b]	Accurately conducts simple computations and statistical analysis using collected data; correlates experimental results to known theoretical values; accounts for measurement errors and parameters that affect experimental results.	Conducts simple computations and statistical analysis using collected data with minor error; reasonably correlates experimental results to known theoretical values; attempts to account for measurement errors and parameters that affect experimental results.	Unable to conduct simple statistical analysis on collected data; no attempt to correlate experimental results with known theoretical values; incapable of explaining measurement errors or parameters that affect the experimental results.
7. Computer Use [b]	Uses computer to collect and analyze data effectively.	Uses computer to collect and analyze data with minor error.	Does not know how to use computer to collect and analyze data.

Assessment Rubrics for ME410 – Heat Transfer

Method: One project and the final exam.

Curriculum Outcomes Assessed:

- a: an ability to apply knowledge of math, science and engineering
- c: an ability to design a system, component, or process to meet desired needs
- e: an ability to identify, formulate and solve engineering problems
- g. an ability to communicate effectively (g1: written)
- k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Performance	Exceeds expectations (5)	Meets expectations (3)	Does not meet expectations (1)
1. Heat and Fluid System [a, e]	Effectively models and applies heat/ fluid principles to thermal/ fluid problems	Being able to model and apply heat/fluid principles to thermal/fluid problems with minor errors	Does not know how to apply heat/ fluid principles to thermal/fluid problems
2. Application of Mathematics [a]	Effectively uses differential equations to solve heat/fluid problems	Being able to use differential equations to solve heat/fluid problems with minor errors	Does not know how to use differential equations to solve heat/fluid problems
3. Calculation/ Solution [e]	Executes calculation correctly by hand and/or using mathematical software	Minor errors in calculations by hand or using mathematical software	Calculations are not performed or are performed incorrectly by hand or does not know how to use mathematical software

4. Design of Heat Transfer Process [c]	Effectively uses and applies heat transfer principles to a design problem/project	Being able to use and apply heat transfer principles to a design problem/project with minor errors	Uses and applies heat transfer principles to a design problem/project with substantial errors
5. Project Report: Content/Organization/English [g1]	Report well organized, appropriately sectioned, no grammar or spelling errors, uses professional style	Report reasonably well documented. May be lacking some minor aspects	Report not well organized, lacks key aspects
6. Use of Computer [k]	Effectively uses computer and software for solving heat/fluid problems	Is able to use computer and software for solving heat/fluid problems, but has minor errors	Does not use computer and software for solving heat/fluid problems or has substantial errors

Assessment Rubrics for ME410L – Thermal Science Laboratory

Method: Lab reports and instructor observation

Outcomes Assessed:

- b.** an ability to design and conduct experiments, as well as to analyze and interpret data
- d.** an ability to function on multi-disciplinary teams
- g.** an ability to communicate effectively

Performance	Exceeds expectation (5)	Meets expectation (3)	Does not meet expectations (1)
1. Data Reduction and Analysis [b]	Able to correctly analyze and interpret experimental data and compare results with theory or empirical correlations, accurately perform experimental uncertainty analysis, and draw conclusions	<i>Able to analyze and interpret data, with minor errors, results are somewhat compared with theory or empirical correlations, aware of experimental uncertainty analysis, draws reasonable conclusions</i>	<i>Makes numerous mistakes in data analysis and interpretation; Does not compare results with theory or empirical correlations, fails to perform uncertainty analysis, draws wrong conclusions</i>
2. Experimental Safety [b]	<i>Carefully observes lab safety rules and procedures</i>	<i>Observes lab safety rules and procedures with guidance.</i>	<i>Acts carelessly and fails to follow safety rules</i>
3. Equipment Selection	<i>Logically and carefully selects equipment to be used for the experiment;</i>	<i>Able to select equipment to be used for the experiment with</i>	<i>Does not understand the connection between the equipment and the</i>

and Setup [b]	correctly setup the connection/wiring of the equipment	<i>guidance</i> ; correctly setup the connection/wiring of the equipment, with minor error	measurement to be used; or did not know how to setup the connection/wiring
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4. Equipment Operation [b]	Operates equipment in <i>correct & careful fashion, Selects optimum range/setting for operation</i>	Operates equipment in correct & careful fashion, <i>with guidance, understand the optimum range/setting for operation</i>	<i>Does not know</i> how to operate equipment; <i>has no knowledge of measurement optimum range/setting for operation</i>
5. Data Collection [b]	Collects data <i>in a neat, logical order & completely</i> with correct units and number of significant digits	Collects data in a logical order & completely with correct units and number of significant digits, <i>with minor errors.</i>	Collects data <i>in a sloppy, illogical order & incompletely. Does not know</i> the concept of correct units and number of significant digits
6. Documentation: Content/Organization [g1]	Lab reports <i>well organized, neat</i> according guidelines	Lab reports <i>reasonably well organized</i> according guidelines	Lab reports <i>poorly organized</i>
7. Documentation: English and format [g1]	<i>Effective use</i> of English language, <i>correct spelling and grammar</i> , technical terminology and proper results interpretation	<i>Proper use</i> of English language, spelling and correct grammar, technical terminology and proper results interpretation, <i>with minor errors and inaccuracy</i>	<i>Poor use</i> of English language, <i>incorrect spelling and grammar</i> and technical terminology; and <i>wrong</i> results interpretation
8. Teamwork [d]	Actively engages and cooperates with other group members in an effective manner.	Cooperates with other group members in a reasonable manner.	Distracts or discourages other group members from conducting the experiment.

Assessment form for ME 482/484 – Mechanical Engineering Design

Method: Written project proposal, oral presentation of the project proposal, peer evaluation of each other in the team, written project report, oral presentation of the project, essay on life-long learning, an essay on ethical issues and societal impact.

Outcomes Assessed:

- c. an ability to design a system, component, or process...
- d. an ability to function on a multi-disciplinary team
- f. an understanding of professional and ethical responsibility
- g. an ability to communicate effectively (g1: written, g2: oral)
- h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- i. a recognition of the need for, and an ability to engage in life-long learning
- j. a knowledge of contemporary issues
- k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Performance	Exceeds expectation (5)	Meets expectation (3)	Does not meet expectation (1)
1. Design strategy [c]	Carefully plans and sets objectives as well as how to achieve the objectives. Readily uses alternative methods when necessary.	Plans and sets objectives, but how to achieve the objectives is not clearly stated. There is no alternative method proposed.	Does not have a working design strategy.
2. Background research: Literature Review [c, h]	Finds 5 or more scholarly articles that are closely related to the project; thoroughly discusses the connection between those articles and the project	Finds 3 or more scholarly articles closely related to the project and at least two other sources that are either not scholarly or not closely related; discussion of sources is fairly thorough	Finds less than 3 closely related scholarly articles or the discussion of the articles is cursory

3. Constraints [c]	Knows the constraints and accounts for them in developing the design strategy, including economic, ethical, social, cultural, and environmental constraints	Knows the constraints and accounts for them in developing the design strategy with minor error or ignores one or two economic, ethical, social, cultural, or environmental constraints	Does not know about the constraints or does not account for them in the design strategy or ignores more than two economic, ethical, social, cultural, or environmental constraints
4. Attendance [d]	On time at all meetings.	Sometimes late at meetings.	All the times late and often no show at meetings.
5. Participation [d]	Plays actively the assigned role, takes on extra work to assist others, and takes the lead in situations when everyone is hesitant.	Plays own role appropriately, and expect others to play theirs.	Frequently absent, ineffective, and blames others for own issues and problems.

6. Contribution [d]	Contributes well prepared and organized ideas, share information outside meetings via electronic means, shares credit for success.	Contributes good ideas at meetings and shares credit for success.	Does not contribute to meeting discussions, and participate passively at meetings.
7. Ethics [f]	Identifies the ethical issues associated with the project and discusses these issues thoroughly	Identifies most of the ethical issues associated with project, but misses some; discussion of the issues in the text is not completely thorough	Fails to recognize key issues or the discussion is cursory
8. Behavior and responsibility [f, d]	Respect others, uses balanced and objective judgment, takes personal responsibility for own actions.	Sometimes does not respect others, does not use balanced and objective judgment, and does not take personal responsibility for own actions.	Often does not respect others, does not use balanced and objective judgment, and does not take personal responsibility for own actions.
9. Problem formulation [g1]	Problem clearly stated and well-defined; concepts and ideas are clearly articulated and formulated	Problem statement is mostly clear and fairly well-defined; concepts and ideas are formulated with minor error	Problem statement is unclear or poorly defined; concepts and ideas are poorly articulated and formulated

10. Organization [g1]	Materials are organized in logical sequences with headings, sub-headings and paragraphs, making it easy for the reader to go through and understand.	Materials are organized in logical sequences with headings, sub-headings and paragraphs, but some section and sub-section are not clearly identified, and some paragraphs combine multiple thoughts.	Poor organization: no structures such as sub-headings and paragraph, and no sequential flow of materials and thoughts.
11. Format/style [g1]	Accurate and proper use of figures, tables and captions, references and bibliography, and appendices.	Proper use of figures, tables and captions, references and bibliography, and appendices with minor error.	Inappropriate use of figures, tables and captions, references and bibliography, and appendices with major errors.
12. Grammar and spelling [g1]	Correct.	Minor mistakes.	Incorrect most of the times.
13. Appearance [g2]	Neat and professional.	Casual but appropriate.	Inappropriate.
14. Delivery [g2]	Effective and well organized delivery.	Delivery with minor error, but can be followed and understood.	Poor delivery, difficult to follow and understand.

15. Features [g2]	Uses effective eye contact and voice projection, speaks comfortably and smoothly, does not block visual aides.	Has some difficulty with eye contact and voice projection, occasionally blocks screen and shows nervousness.	Has major difficulties with eye contact and voice projection, blocks the screen and reads from it. Displays most of the times signs of nervousness.
16. Visual aides [g2, k]	Uses visual aides effectively.	Uses visual aides with minor error.	Uses visual aides poorly.
17. Listening to and answering questions [g2]	Carefully listens to questions and responds appropriately.	Listen to questions and responds with minor error.	Misunderstand questions and provides wrong answers.
18. Background issues [h]	Does researches and is familiar with historical, social, cultural, environmental, and ethical background and issues.	Is somewhat familiar with historical, social, cultural, environmental, and ethical background and issues.	Is not at all familiar with historical, social, cultural, environmental, and ethical background and issues.

19. Contemporary Issues [h, j]	Identifies the contemporary issues associated with the project and discusses these issues thoroughly in the proposal	Identifies most of the contemporary issues associated with project, but misses some; discussion of the issues in the text is not completely thorough	Fails to recognize key issues or the discussion is cursory
20. Recognizes the need for life-long learning (LLL) [i]	Makes a strong argument connecting the need for LLL to his or her career plans	Mentions why LLL is important in his or her LLL plan	Fails to mention why LLL is necessary or down plays its importance
21. Feels prepared for LLL [i]	Makes a strong argument for how the SIUE ME program has prepared him or her for LLL	Mentions ways that the SIUE ME program has prepared him or her for LLL	Fails to mention feeling prepared for LLL or says he or she does not feel prepared
22. Computers and Software [k]	Computer-based tools and technical software were used extensively in the project; new software was learned as needed	Computer-based tools and technical software were somewhat utilized; some effort was put into learning new software as needed	Technical software was not utilized; no attempt was made at learning new software