Assessment Rubrics

Assessment Rubric for MRE320 – Sensors and Actuators

Method: Laboratory assignments, midterm and one final project

Outcomes Assessed:

5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

Performance	Exceeds expectation (5)	Meets expectation (3)	Does not meet expectations (1)
1. Knowledge and application [1]	Applies the appropriate knowledge and concepts to complex engineering problems 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 [1]	The question to be solved is accurately identified. Able to identify that the problems may have many component parts or sub-problems, which may involve knowledge from multiple disciplines	The question to be solved is identified largely correctly with possible minor mistakes. Understand the complexity of the problems.	The question to be solved is identified substantially wrong. Fails to identify the complexity of the problems.
3. Problem setup [1]	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 [1]	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. Teamwork [5]	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.

6. Design and Develop of Experiment [6]	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.
7. Conducting Experiment [6]	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.
8. Laboratory Safety Rules [6]	Respectfully and carefully observes safety rules and procedures	Observes safety rules and procedures with minor deviation.	Disregards safety rules and procedures.
9. Data Collection [6]	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.
10. Data Analysis [6]	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. Able to use engineering judgement to draw correct conclusions.	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. Able to draw conclusion with minor errors.	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. Unable to draw correct conclusion.

Assessment Rubric for MRE358 – Introduction to Mechatronics

Method: Laboratory assignments, team projects

Outcomes Assessed:

4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

Performance	Exceeds expectation (5)	Meets expectation (3)	Does not meet expectations (1)
1. Ethics and professional responsibilities [4]	Identifies the ethical issues and the professional responsibilities associated with the project and discusses these issues thoroughly	Identifies most of the ethical issues and the professional responsibilities 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
2. Informed Judgements [4]	Does researches and is familiar with the impact of engineering solutions in global, economic, environmental, and societal contexts.	Is somewhat familiar with the impact of engineering solutions in global, economic, environmental, and societal contexts	Is not at all familiar with the impact of engineering solutions in global, economic, environmental, and societal contexts
3. Teamwork [5]	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.
4. Design and Develop of Experiment [6]	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.
5. Conducting Experiment [6]	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.

6. Laboratory Safety Rules [6]	Respectfully and carefully observes safety rules and procedures	Observes safety rules and procedures with minor deviation.	Disregards safety rules and procedures.
7. Data Collection [6]	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.
8. Data Analysis [6]	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. Able to use engineering judgement to draw correct conclusions.	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. Able to draw conclusion with minor errors.	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. Unable to draw correct conclusion.

Assessment Rubrics for ME 356 – Dynamical Systems Modeling

Method: One project and the final exam.

Outcomes Assessed:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

Performance	Exceeds expectation (5)	Meets expectation (3)	Does not meet expectation (1)
1. Knowledge and application [1]	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 [1]	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 [1]	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 [1]	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.

Assessment Rubrics for MRE 380 – Design of machine elements

Method: One project and the final exam.

Outcomes Assessed:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences

Performance	Exceeds expectation (5)	Meets expectation (3)	Does not meet expectation (1)
1. Knowledge and application [1]	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 [1]	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 [1]	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 [1]	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.
5. Design strategy [2]	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 [2]	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	Fails to consider important alternatives or shows complete lack of understanding pros and cons of alternatives

		discussing the pros and cons of different alternatives	
7. Constraints [2]	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 [2,3]	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 [3]	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 MRE 454 – Robotics: Dynamics and Control

Method: One project, midterm and final exam.

Outcomes Assessed:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Performance	Exceeds expectation (5)	Meets expectation (3)	Does not meet expectation (1)
1. Knowledge and application [1]	Applies the appropriate knowledge and concepts to the complex engineering 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 [1]	The question to be solved is accurately identified. Able to identify that the problems may have many component parts or sub-problems, which may involve knowledge from multiple disciplines	The question to be solved is identified largely correctly with possible minor mistakes. Understand the complexity of the problems.	The question to be solved is identified substantially wrong. Fails to identify the complexity of the problems.
3. Problem setup [1]	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 [1]	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. Acquire and apply new knowledge [7]	Successfully identity all the new knowledge needed for the project, Acquire and apply those knowledge as needed.	Able to identify, acquire and apply most new knowledge needed for the project.	Fail to identify new knowledge needed for the project. Not able to acquire and apply any new knowledge.

Assessment Rubrics for MRE 480/481 – Design in Mechatronics and Robotics I & II

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:

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Performance	Exceeds expectation (5)	Meets expectation (3)	Does not meet expectation (1)
1. Design strategy [2]	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 [2]	Finds 5 or more sources that are closely related to the project; thoroughly discusses the connection between those articles and the project	Finds 3 or more sources 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 sources or the discussion of the articles is cursory
3. Constraints [2]	Knows the constraints and accounts for them in developing the design strategy, including public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	Knows the constraints and accounts for them in developing the design strategy with minor error or ignores one or two constraints	Does not know about the constraints or does not account for them in the design strategy or ignores more than two constraints
4. Problem formulation [3]	Problem clearly stated and well-defined; concepts and ideas are	Problem statement is mostly clear and fairly well-defined; concepts	Problem statement is unclear or poorly defined; concepts and ideas are

	clearly articulated and formulated	and ideas are formulated with minor error	poorly articulated and formulated
5. Organization [3]	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.
6. Format/style and Grammar [3]	Accurate and proper use of figures, tables and captions, references and bibliography, and appendices. Correct grammar	Proper use of figures, tables and captions, references and bibliography, and appendices with minor error. Minor grammar mistakes	Inappropriate use of figures, tables and captions, references and bibliography, and appendices with major errors. Most of the time use incorrect grammar
7. Communication Effectiveness [3]	Able to communicate effectively with a range of audiences that include students, faculty, engineers and industry sponsors.	Able to communicate with most of the audiences, with minor communication problems.	Poor communication skills and cannot be understood by audiences.
8. Appearance [3]	Neat and professional.	Casual but appropriate.	Inappropriate.
9. Delivery [3]	Effective and well organized delivery.	Delivery with minor error, but can be followed and understood.	Poor delivery, difficult to follow and understand.
10. Features [3]	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.
11. Visual aides [3]	Uses visual aides effectively.	Uses visual aides with minor error.	Uses visual aides poorly.
12. Listening to and answering questions [3]	Carefully listens to questions and responds appropriately.	Listen to questions and responds with minor error.	Misunderstand questions and provides wrong answers.
13. Ethics and professional responsibilities [4]	Identifies the ethical issues and the professional responsibilities associated with the project and discusses these issues thoroughly	Identifies most of the ethical issues and the professional responsibilities 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

14. Informed Judgements [4]	Does researches and is familiar with the impact of engineering solutions in global, economic, environmental, and societal contexts.	Is somewhat familiar with the impact of engineering solutions in global, economic, environmental, and societal contexts	Is not at all familiar with the impact of engineering solutions in global, economic, environmental, and societal contexts
15. Attendance [5]	On time at all meetings.	Sometimes late at meetings.	All the times late and often no show at meetings.
16. Participation [5]	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.
17. Contribution [5]	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.
18. Collaboration and inclusion [5]	Be collaborative and inclusive, 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.
19. Acquire and apply new knowledge [7]	Successfully identity all the new knowledge needed for the project, Acquire and apply those knowledge as needed.	Able to identify, acquire and apply most new knowledge needed for the project.	Fail to identify new knowledge needed for the project. Not able to acquire and apply any new knowledge.
20. Learning Strategies [7]	Apply the best learning strategies for current problems, such as courses, research, interviewing experts, etc.	Able to apply appropriate learning strategies for the problems.	Fail to incorporate any appropriate learning strategies for the problems