PARC 2019 Engineering Design Process Judging Rubric

Date of Submission:	
Title of Project	
Summary of Project:	

	Element	5 Exemplary	4 Proficent	3 Competent	2 Apprentice	1 Novice	Score
Performance Criteria	**A. Presentation and justification of the problem**	The problem is clearly and objectively identified and defined with considerable detail; the justification of the problem highlights the concerns of primary stakeholders and is based on comprehensive, timely, and credible sources; it offers detail from which multiple measurable design requirements can be determined.	The problem is clearly and objectively identified and defined with some detail; the justification of the problem highlights the concerns of some primary stakeholders and is based on various timely and generally credible sources; it offers generally objective detail from which multiple measurable design requirements can be determined.	The problem is somewhat clear and objective; sometimes has detail though some information intended as elaboration may be imprecise or general; justification of the problem highlights the concerns of a few primary stakeholders based on a few sources that are timely and credible; justification allow at least a few measurable design requirements to be determined.	The problem is somewhat clear and/or objectively defined with somewhat superficial and/or minimal detail; justification of the problem highlights concerns of only 1-2 primary stakeholders based on sources that are insufficient, outdated or of dubious credibility; enough detail to allow a few design requirements to be determined; however, they may not be measurable.	The identification and/or definition of the problem is unclear, unelaborated, and/or clearly subjective; any intended justification of the problem does not highlight the concerns of primary stakeholders and/or is based on sources that are overly general, outdated, and/or of dubious credibility; insufficient information for the determination of measurable design requirements.	
	B. Documentation and analysis of prior solution attempts	Documentation of plausible prior attempts to solve the problem and/or related problems is drawn from a wide array of clearly identified and consistently credible sources; the analysis of past and current attempts to solve the problem—including both strengths and shortcomings— is consistently clear, detailed, and supported by relevant data.	Documentation of existing attempts to solve the problem and/or related problems is drawn from a variety of clearly identified and consistently credible sources; the analysis of past and current attempts to solve the problem—including both strengths and shortcomings—is clear and is generally detailed and supported by relevant data.	Documentation of existing attempts to solve the problem and/or related problems is drawn from several—but not varied—clearly identified and generally credible sources; the analysis of past and current attempts to solve the problem—including both strengths and shortcomings—is generally clear and contains some detail and relevant data.	Documentation of existing attempts to solve the problem and/or related problems is drawn from a limited number of sources, some may not be clearly identified and/or credible; the analysis of past and current attempts to solve the problem—including strengths and shortcomings—is overly general containing little detail/ relevant data.	Documentation of existing attempts to solve the problem and/or related problems is drawn from only 1-2 sources that may not be clearly identified and/or credible; the analysis of past and current - attempts to solve the problem—including strengths and/or shortcomings—is vague and missing relevant details and/or supporting data.	
	C. Presentation and justification of solution design requirements	Design requirements are listed and prioritized with clarity and detail; they are consistently objective, measurable, and would highly likely lead to a tangible and viable solution to the problem identified; there is evidence that requirements represent the needs of, and have been validated by, many if not all primary stakeholder groups.	Design requirements are listed and prioritized, generally clear and detailed, nearly always objective and measurable, and would likely lead to a tangible and viable solution to the problem identified; there is evidence that requirements represent the needs of, and have been validated by, several primary stakeholder groups.	Design requirements are listed and prioritized, generally clear and somewhat detailed; generally objective and measurable with the potential to lead to a tangible and viable solution to the problem identified; there is evidence that requirements represent the needs of, and have been validated by, at least a few primary stakeholder groups.	Design requirements are listed and prioritized, some/all may be incomplete and/or lack specificity; they are sometimes objective and/or measurable, it is not clear it will lead to a tangible and viable solution; there is evidence that the requirements represent the needs / have been validated by only one primary stakeholder group.	An attempt is made to list, format, and prioritize requirements, but these may be partial and/or overly general, making them insufficiently measurable to support a viable solution to the problem identified; there is no evidence that the requirements represent the needs of, or have been validated by, any primary stakeholder groups.	
	D. Design concept generation, analysis, and selection	The process for generating and comparing possible design solutions was comprehensive, iterative and consistently defensible; design solution is highly likely viable, well justified with attention to all design requirements; plan of action has considerable merit, easily supporting the repetition and testing for effectiveness by others.	The process for generating and comparing possible design solutions was thorough, iterative, and generally defensible, design solution is likely viable; justified with attention to most if not all design requirements; the plan of action would support repetition and testing for effectiveness by others.	The process for generating and comparing possible design solutions was adequate and generally iterative and defensible, design solution is possibly viable explained with reference to at least some design requirements; the plan of action might not clearly or fully support repetition and testing for effectiveness by others.	The process for generating a possible design solution was partial or overly general and only somewhat iterative and/or defensible, design solution has issues with viability and was not sufficiently explained with reference to design requirements; there is insufficient detail to allow for testing for replication of results.	The process for generating a possible design solution was incomplete and was only minimally iterative and/or defensible; any attempted explanation for the design solution chosen lacked support related to design requirements and cannot be tested.	
	E. Application of STEM principles and practices	The proposed solution is well-substantiated with STEM principles and practices applicable to nearly/all design requirements and functional claims; there is substantial evidence that the application has been reviewed by two or more experts or project mentors providing verification or detail necessary to inform a corrective response.	The proposed solution is generally substantiated with STEM principles and practices applicable to some design requirements and functional claims; there is some evidence that the application has been reviewed by at least two experts or project mentors providing verification or some detail necessary to inform a corrective response.	The proposed solution is partially substantiated with STEM principles and practices applicable to a few design requirements and functional claims; there is some evidence that the application has been reviewed by at least one expert or project mentor but there is no clear verification to inform a corrective response.	The proposed solution is minimally substantiated with STEM principles and practices applicable to a few design requirements and functional claims; there is minimal evidence that the application has been reviewed by at least one expert or project mentor but there is no evidence of verification to inform a corrective response.	The proposed solution is minimally substantiated with STEM principles or practices applicable to a few design requirements and functional claims; however, there is no evidence that the application has been reviewed by an expert qualified consultant or project mentor.	
	F. Consideration of design viability	The proposed design was carefully reviewed based on several relevant extra-functional considerations; a judgment about design viability based on those considerations—the capacity of the proposed solution to address the problem—is clearly realistic and well supported with credible evidence.	The proposed design was adequately reviewed based on several relevant extra-functional considerations; a judgment about design viability based on those considerations—capacity of the proposed solution to address the problem—is generally realistic and adequately supported with credible evidence.	The proposed design was partially reviewed based on one or two relevant extra-functional considerations; a judgment about design viability based on those considerations—capacity of the proposed solution to address the problem—is only somewhat/sometimes realistic, partially supported with credible evidence.	The proposed design was superficially reviewed based on one or two relevant extra-functional considerations; a judgment about design viability based on those considerations—capacity of the proposed solution to address the problem—is generally unrealistic and/or inadequately supported with credible evidence.	The proposed design was superficially reviewed based on one or two extra-functional considerations of marginal relevance; a judgment about design viability based on those considerations—capacity of the proposed solution to address the problem—may be unrealistic and/or not supported with any credible evidence.	

	G. Construction of a testable prototype	The final prototype iteration is clearly and fully explained, with enough detail to assure that objective data on nearly/all design requirements could be determined; all attributes of the unique solution that can be tested or modeled mathematically are addressed; a well-supported justification is provided for items that require expert review.	The final prototype iteration is clearly and adequately explained, with enough detail to assure that objective data on many design requirements could be determined; most attributes of the unique solution that can be tested or modeled mathematically are addressed, general justification is provided for items that require expert review.	The final prototype iteration is clearly and adequately explained, with enough detail to assure that objective data on some design requirements could be determined; some attributes of the unique solution that can be tested or modeled mathematically are addressed, adequate justification is provided for items that require expert review.	The final prototype iteration is explained only somewhat clearly/ completely, with enough detail to assure that objective data on a few design requirements could be determined; few attributes of the solution can be tested or modeled mathematically are addressed, insufficient justification for items that require expert review.	The final prototype iteration is only minimally explained, with enough detail to assure that objective data on at least one design requirements could be determined; no more than one attribute of the solution that can be tested or modeled mathematically is addressed, justification for items that require expert review is missing.	
	H. Prototype testing and data collection plan	The testing plan addresses nearly/ all of the high priority design requirements by effectively describing the conduct (physical and/or mathematical modeling) feasibility and providing a logical, well-developed explanation confirmed by one or more field experts of how testing would yield objective data regarding effectiveness of the design.	The testing plan addresses many of the high priority design requirements by generally describing the conduct (physical and/or mathematical modeling) feasibility and providing a logical, generally developed explanation confirmed by one or more field experts of how testing would yield objective data regarding effectiveness of the design.	The testing plan addresses some of the high priority design requirements by adequately describing the conduct (physical and/or mathematical modeling) feasibility and providing a logical, adequately developed explanation confirmed by one or more field experts of how testing would yield objective data regarding effectiveness of the design.	The testing plan addresses a few of the high priority design requirements by partially describing the conduct (physical and/or mathematical modeling) feasibility and providing a somewhat logical, partially developed explanation confirmed by one field expert of how testing would yield objective data regarding effectiveness of the design.	The testing plan addresses one of the high priority design requirements by describing at least minimally the conduct (physical and/or mathematical modeling) feasibility and/or providing a generally logical and/or partially developed explanation (no expert input) of how testing would yield objective data regarding the effectiveness of the design.	
	I. Testing, data collection and analysis	Through the conduct of several tests for high priority requirements that are reasonable, physical or mathematical modeling; considerable understanding of testing procedure, including the gathering and analysis of resultant data; the analysis of the effectiveness with which the design met stated goals; consistently detailed explanation of the data from each portion of the testing procedure and from expert reviews, generously supported by pictures, graphs, charts and other visuals; overall summary of the implications of all data for proceeding with the design and solving the problem.	Through the conduct of several tests for high priority requirements that are reasonable, physical or mathematical modeling; ample understanding of testing procedure, including the gathering and analysis of resultant data; the analysis of the effectiveness with which the design met stated goals; generally detailed explanation of the data from each portion of the testing procedure and from expert reviews, generally supported by pictures, graphs, charts and other visuals; overall summary of the implications of most if not all of the data for proceeding with the design and solving the problem.	Through the conduct of a few tests for high priority requirements that are reasonable, physical or mathematical modeling; adequate understanding of testing procedure, including the gathering and analysis of resultant data; the analysis of the effectiveness with which the design met stated goals; somewhat detailed explanation of the data from each portion of the testing procedure and from expert reviews, somewhat supported by pictures, graphs, charts and other visuals; summary of the implications of at least some of the data for proceeding with the design and solving the problem.	Through the conduct of one or two tests for high priority requirements that are reasonable, physical or mathematical modeling; partial or overly general understanding of testing procedure, including the gathering and analysis of resultant data; the analysis of the effectiveness with which the design met stated goals includes a partial explanation of the data (partially complete and/or partially correct), minimally supported by pictures, graphs, charts and other visuals; the analysis includes a partial and/or overly-general summary of the implications of at least some of the data for proceeding with the design and solving the problem.	Through the conduct of one or two tests for requirements (which may or may not be high priority) that are reasonable physical or mathematical modeling; minimal understanding of testing procedure, including the gathering and analysis of resultant data; the analysis of the effectiveness with which the design met stated goals includes an attempted explanation of the data but may not be supported by any pictures, graphs, charts or other visuals; the analysis may be missing even a partial and/or overly-general summary of the implications of any of the data for proceeding with the design and solving the problem.	
	J. Documentation of external evaluation	Documentation of project evaluation by multiple, demonstrably qualified stakeholders and field experts is presented and is synthesized in a consistently specific, detailed, and thorough way; documentation is sufficient in two or more categories to yield meaningful analysis of that evaluation data; the synthesis of evaluations consistently addresses evaluators' specific questions, concerns, and opinions related to design requirements.	Documentation of project evaluation by two or more demonstrably qualified stakeholders and field experts is presented and is synthesized in a generally specific, detailed, and thorough way; documentation is sufficient in at least one category to yield a meaningful analysis of that evaluation data; the synthesis of evaluations generally addresses evaluators' specific questions, concerns, and opinions related to design requirements.	Documentation of project evaluation by three or four demonstrably qualified stakeholders and/or field experts is presented and is synthesized in a somewhat specific and detailed way, but may not be thorough; documentation may not be sufficient in any category to yield a meaningful analysis of that evaluation data; the synthesis of evaluations addresses at least some of evaluators' specific questions, concerns, and opinions related to design requirements.	Documentation of project evaluation by two or three representatives of stakeholders and/or field experts (some of whom may not be demonstrably qualified) is presented and is synthesized in a somewhat specific and/or detailed but incomplete or overly general way; the synthesis of evaluations addresses at least a few of evaluators' specific questions, concerns, and/or opinions related to design requirements.	Documentation of project evaluation by one or two representatives of stakeholders and/or field experts is presented but synthesis is sparse, with few specifics/details; the synthesis of evaluations addresses only one or two of an evaluator's questions, concerns, and/or opinions related to design requirements.	

(Modified version of the Innovation Portal Judging Rubric)