İTÜ Geophysical Engineering Undergraduate Program – Student Outcomes – Rubric Table
(06.01.2021)

SO1. An ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science, and mathematics

Performance Indicator (PI)	Unsatisfactory (1)	Developing (2)	Satisfactory (3)	Outstanding (4)	Score
PI-1: Application of Mathematics in Geophysical Engineering Problems	Uses incorrect math expressions most of the time; calculations not performed or performed incorrectly; barely able to apply knowledge of calculus, vector analysis and linear algebra.	Occasionally uses incorrect math expressions; calculations performed with minor errors; to some extent is able to apply knowledge of calculus, vector analysis, linear algebra, diff. eqns.	Uses correct math expressions most of the time; calculations performed correctly most of the time; reasonably able to apply knowledge of calculus, vector analysis, linear algebra, diff. eqns.	All math expressions are correct; calculations performed correctly; excellent ability to apply knowledge of calculus, vector analysis, linear algebra., diff. eqns.	
PI-2: Application of Scientific and Engineering Principles	Poor ability to use scientific and engineering principles to formulate a model and/or solution for geophysical engineering problems.	Can, to some degree, use scientific and engineering principles to formulate a model and/or solution for geophysical engineering problems.	Reasonably able to use scientific and engineering principles to formulate a model and/or solution for geophysical problems.	Fully able to use scientific principles to formulate a model and/or solution for geophysical engineering problems.	
PI-3: Subject Knowledge in Terms of Science and Engineering	Poor or no understanding of the fundamental theories and/or principles in engineering and earth sciences and their relation to geophysical phenomena and/or problems.	Aware of the fundamental theories and/or principles in engineering and earth sciences but has some difficulties in relating them to geophysical phenomena and/or problems.	Has a reasonable grasp of the fundamental theories and/or principles in engineering and earth sciences and is generally able to relate them to geophysical phenomena and/or methods.	Has full command of the fundamental theories and/or principles in engineering and earth sciences and excellently relates them to geophysical phenomena and/or problems.	
Overall Performance	**Unsatisfactory**	**Developing**	**Satisfactory**	**Outstanding**	**Total**
Total Points	**0-3**	**4-6**	**7-9**	**10-12**	**12**

SO2. 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

Performance Indicator (PI)	Unsatisfactory (1)	Developing (2)	Satisfactory (3)	Outstanding (4)	Score
PI-1: Identification of the Geological Problem	Lack of ability to use theoretical knowledge for defining the geological problems	Fair ability to use theoretical knowledge for defining the geological problems	A reasonable ability to use theoretical knowledge for defining the geological problems	Perfect at describing the geological problems and at explaining selected tools to be used for the solution.	
PI-2: Designing solution(s) by Geophysical Engineering Method(s) in accordance with Engineering Design Principles.	Does not have any required knowledge/skills gained through early courses; does not have any idea on the possible final product of the design project; lack of knowledge on the design/solution criteria and unaware of the specifications related to the engineering problem; unaware of geophysical methods and relevant designed parameters within engineering standards/principles with a consideration of multiple factors (e.g. public health, safety, welfare, as well as global, cultural, social, environmental, and economic).	Has unsatisfying required knowledge/skills gained through early course; Able to perceive the final product of the design project but poor in relating their significance with the main objective; has a moderate knowledge on the design/solution criteria and specifications related to the engineering problem; Some awareness for geophysical methods and relevant designed parameters within engineering standards/principles; somewhat knowledgeable on applying suitable geophysical methods that satisfy specific needs considering multiple factors	Fairly equipped with the required knowledge/skills gained through early course; Clearly understand the final product of the design project and its importance for the main problem; has an ability to determine proper the design/solution criteria and has a clear knowledge on technical specifications; quite skilled at design process of the field experiment by considering engineering standards/principles with a proper consideration of multiple factors; complete awareness on the relation between geophysical surveys with the geological problems.	Has the required knowledge/skills gained through early course at excellent level; a well understanding the final product of the design project and able to establish a perfect link between its importance and the problem; best-example with the knowledge on the design/solution criteria and specifications; can decide on them under different circumstances (e.g. data-related, study area related etc.); highly skilled at every step of the design process of field experiment by considering engineering standards/principles with a consideration of multiple-factors; excellent in knowing more than a single geophysical method suitable for a given geological problem; compares the advantages and disadvantages of various methods (e.g. resolution, noise, etc.)	
Overall Performance	**Unsatisfactory**	**Developing**	**Satisfactory**	**Outstanding**	**Total**
Total Points	**0-2**	**3-4**	**5-6**	**7-8**	**8**

SO3. An ability to communicate effectively with a range of audiences

Performance Indicator (PI)	Unsatisfactory (1)	Developing (2)	Satisfactory (3)	Outstanding (4)	Score
PI-1: Technical Communication Skills (Oral/Written)	Poor at describing the main objective; improper design of the main content; poor command on the subject; lack of ability to perform a technical literature survey; poor at understanding the questions and critics/comments; lack of clarity; does not acknowledge others' work; incomplete presentation of results with insufficient visual materials; have problems at being understandable by experts.	Deficiencies when describing the main objective; content needs improvement; does have an intermediate knowledge on the problem; literature survey is poor; understands questions and critics/comments but cannot answer them; occasionally unfair acknowledgement of others' work; organization of the talk with insufficient presentation of results and conclusions needs enhancement; must enhance speaking skills to be better understood by experts	Can highlight the main objective; good content of presentation; an adequate knowledge of the subject; performs broad technical literature survey; understands questions and critics/comments and a fair ability to answer them; fairly consistent acknowledgement of others' work; organization of the talk is overall good with a proper presenting of results and conclusions; able to interpret findings within the light of initial engineering problem; a good speaking skill and well understood by experts	Perfect identification of the main objective; very successful in highlighting key issues; deep knowledge of the subject; complete technical literature survey; a perfect understanding the questions and critics/comments and can answer them by using proper examples of results; fully consistent acknowledgement of others' work; very good organization of the talk; competent at using multiple data to support results and interpretation; very well speaking skills and finally able to add take-home message(s) related to further work.	
PI-2: Non-Technical Communication Skills (Oral/Written)	Poor command on the subject; has not chosen a catchy title; Inadequate design of the main content; makes confusion using improper technical material and terminology; not able to set a clear link between problem objective and the results; lack of presenting skills with insufficient visual materials; lack of ability to emphasize the importance of subject in societal interests.	Somewhat knowledgeable on the subject but needs improvement; inadequate at choosing a catchy title; content needs improvement; makes confusion using proper but too technical material and terminology; have a fair sense of the link between problem objective and the results; have a presentation using moderate amount of visual materials; lack of clarity in emphasizing the importance of subject in societal interests.	A clear awareness of the subject; has chosen attractive titles; good content with clear definition of major components; uses simple material and language that can be understood by non-experts; able to set the link between problem objective and the results; have a presentation using adequate amount of visual materials explaining the main objective in a simple manner; good at emphasizing the importance of subject in societal interests.	Has deep knowledge on the subject to be able to simplify the main problem; very attractive and striking titles; very good content and organization with clear definition of major components; uses appropriate visual materials and language that can be understood by non-experts; able to set the link between problem objective and the results; uses a very rich content of visual materials; successfully emphasize the importance of subject in societal interests.	
Overall Performance	Unsatisfactory	Developing	Satisfactory	Outstanding	**Total**
Total Points	0-2	3-4	5-6	7-8	8

SO4. 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

Performance Indicator (PI)	Unsatisfactory (1)	Developing (2)	Satisfactory (3)	Outstanding (4)	Score
PI-1: Sense of Ethics and Ability to Define and Evaluate Ethical Issues	Aware of the importance of ethics in general but not aware of professional ethical codes; Poor at defining and evaluating ethical issues.	Aware of the importance of ethics in general but has some difficulty understanding the professional ethical codes; some deficiencies in defining and evaluating ethical issues.	Demonstrates a reasonable understanding of the importance of ethics and professional ethical codes; understands issues reasonably well and mostly takes an active role in defining and evaluating ethical issues.	Fully recognizes the professional ethical codes; perfectly understands ethical issues and play a key role in defining and evaluating ethical issues.	
PI-2: Ability to Take Professional Responsibility and Make Informed Judgments	Unaware of their professional responsibilities and the impact of engineering solutions to make more informed decisions in global, economic, environmental and social contexts.	Has the potential to understand their professional responsibilities, but is unaware of the impact of engineering solutions to make more informed decisions in global, economic, environmental and social contexts.	Sufficient in making the right decision based on the obtained results considering the importance of engineering solutions in global, economic, environmental and social contexts.	Excellence in making the right decision based on the achieved results by considering the significance of engineering solutions in global, economic, environmental and societal contexts.	
Overall Performance	**Unsatisfactory**	**Developing**	**Satisfactory**	**Outstanding**	**Total**
Total Points	**0-2**	**3-4**	**5-6**	**7-8**	**8**

SO5. 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

Performance Indicator (PI)	Unsatisfactory (1)	Developing (2)	Satisfactory (3)	Outstanding (4)	Score
PI-1: Team Participation	Does not take part in either the design stage or routine field work of the experiment; does not contribute to teamwork.	Rather willing to take part in both design stage and routine field work of the experiment; mostly capable of maintaining team harmony	Takes part, to some degree, in both design and routine fieldwork stages of the experiment; quite capable of maintaining team harmony; able to take initiative at critical steps in design and data collection.	Effectively takes part in both design and field work stages of the experiment; always capable of maintaining team harmony and good at sharing experience	
PI-2: Establish a Collaborative and Inclusive Environment (Leadership)	Unable to take initiative at critical steps in design and data collection; no potential to create a collaborative and motivating environment; very inadequate in setting goals and planning tasks.	Lacks ability in taking initiative at critical steps in design and data collection; fairly potential in leading to create collaborative and motivating environment; poor in establishing goals and plan tasking.	Able to take initiative at critical steps in design and data collection; having a potential in leading to create collaborative and motivating environment; needs improvement on establishing goals and plan tasking.	Demonstrates very high enthusiasm on taking initiative at critical steps in design and data collection; Having a leading position in creating collaborative, motivating environment, determines objectives clearly; able to organize task-planning; highly skilled at contemplating whether the results match the problems initially.	
PI-3: Establishing Goals, Planning Tasks, and Meeting Objectives	Do not establish any goal, there is no planned tasks, and has no understanding of meeting the objectives.	Weak establishment of the goals with improper planning of tasks, poor results meeting with objectives.	Establishing satisfactory goals with proper planning, results meeting with the objectives.	Well-established goals with qualified planning, good results perfectly meeting with the objectives.	
Overall Performance	Unsatisfactory	Developing	Satisfactory	Outstanding	Total
Total Points	0-3	4-6	7-9	10-12	12

SO6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

Performance Indicator (PI)	Unsatisfactory (1)	Developing (2)	Satisfactory (3)	Outstanding (4)	Score
PI-1: Develop and Conduct Field Experiment for Data Collection	Does not follow fieldwork guidelines/instructions and does not show interest in learning while conducting the experiment; missing experiment plan;	Demonstrates an acceptable performance in conducting his/her part of field experiment; might have some difficulties in operating instruments; imperfect experiment plan;	Demonstrates a reasonably good performance in developing and conducting his/her part of field experiment; adequate experiment plan;	Has perfect control over instruments and very careful in making measurements; proposes effective solutions with correct arguments to problems that could be encountered during fieldwork; well thought out experiment plan;	
PI-2: Computational Skills in Data Processing by Using Professional and/or in-house Software	Unable to perform simple tasks such as creating data files, making graphs/charts or maps requiring PC use; unable to use standard geophysical data processing software packages.	Can perform simple tasks such as creating and/or converting data files, making graphs/charts or maps requiring PC use; has some difficulties using the standard geophysical data processing software packages effectively due to weaknesses on the fundamentals of signal/data processing; demonstrates introductory-level skills in writing programs, scripts macros etc. when needed.	Can perform most of the necessary tasks such as format conversion, gridding, reduction, spectral analysis, filtering, visualization etc., requiring PC use; quite knowledgeable using the standard geophysical data processing software packages; has a reasonable grasp of the fundamentals of signal/data processing; demonstrates intermediate-level skills in writing programs, scripts macros etc. when needed.	Can perform all the necessary tasks such as format conversion, gridding, reduction, spectral analysis, filtering, visualization etc., requiring PC use; maintains current, state-of-the-art abilities in computers; competent in effectively using all the modules and/or functions of the standard geophysical data processing software packages; has full command of the fundamentals of the signal/data processing; demonstrates proficiency in writing programs, scripts macros etc. when needed.	
PI-3: Ability to Model Geophysical Data	Does not have any idea on what geophysical data indicate or how modeling is carried out.	Has basic understanding on the implications of geophysical data by identifying relevant anomalies and/or signals; have simple modeling skills requiring graphical analysis of data using type curves etc. but lacks skills for implementing advanced modeling methods.	Good at evaluating the implications of data; can use advanced modeling techniques but might need occasional guidance on model parameterization and implementation of the forward and/or inverse modeling process.	Competent in evaluating implications of the geophysical data by identifying relevant anomalies and/or signals; has full command of the modeling process; very skilled at obtaining a subsurface model by using proper modeling methods.	
PI-4: Draw Conclusions Based on the Interpretation of Processed Data	Cannot incorporate modeling results with the geological and other geophysical data.	Can obtain geological and other geophysical data but has difficulty in incorporating relevant data with the modeling results and thus might need guidance.	Capable of compiling and incorporating relevant geological and other geophysical data at hand and does a reasonable job of incorporating them with the modeling results.	Perfectly incorporates relevant geological and other geophysical data with the modeling results to obtain a geologically plausible model; and is able to determine future strategies for the improvement of solutions obtained.	
Overall Performance	**Unsatisfactory**	**Developing**	**Satisfactory**	**Outstanding**	**Total**
Total Points	**0-4**	**5-8**	**9-12**	**13-16**	**16**

SO7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Performance Indicator (PI)	Unsatisfactory (1)	Developing (2)	Satisfactory (3)	Outstanding (4)	Score
PI-1: Willingness to learn new concepts, technologies, skills and tools in geophysical engineering applications	Unaware of the sources of information and tools regarding innovative technologies; not recognize necessary techniques, skills and tools	Aware of the importance of following new technologies; poor in reaching the right source of information; recognizes some techniques, skills and tools with missing some principal items.	Able to follow new advancements in different fields of geophysical engineering; recognizes almost all of the relevant techniques, skills and tools	Very high sense of following future technologies; recognizes all appropriate techniques, skills and tools.	
PI-2: Ability to apply new knowledge to engineering problems using appropriate learning strategies	Unaware of recent developments in any field of geophysical engineering including software/hardware.	Inability to access new knowledge and technology in consultation with faculty members and / or industry experts.	Makes attempts for reaching new knowledge and technology by consulting faculty members and/or experts in the industry.	Makes attempts at being part of their development or application processes via a close co-operation with faculty members and/or experts in the industry.	
Overall Performance	**Unsatisfactory**	**Developing**	**Satisfactory**	**Outstanding**	**Total**
Total Points	**0-2**	**3-4**	**5-6**	**7-8**	**8**