Appendix L: Solutions through Science Category Course Submission Requirements and Evaluation Criteria and Rubrics

COURSE SUBMISSION REQUIREMENTS

Minimum Required Materials for GEOC Review (per GEOC Standing Rules):

1. Cover Letter/Rationale/Justification
    a. Rationale must include sound justification as to why this course meets the requirements for the Solutions through Science category. The originator must demonstrate how the course will teach to and assess the Student Learning Outcome assigned to the Solutions through Science category.
        i. Critical Thinking and Reasoning: Students will be able to analyze evidence to support or create interpretations, arguments, or claims; identify and analyze the connection between evidence and claims; evaluate the strength and weaknesses of conclusions and opinions; and determine the scope of evidence needed for original arguments.
        ii. Quantitative Reasoning: Students will be able to interpret models and/or solve quantitative problems from different contexts with real-world relevance; create and communicate reasonable arguments supported by quantitative evidence; and clearly communicate those arguments in effective formats (e.g., using words, tables, graphs, and mathematical equations).
        iii. Scientific Reasoning: Students will be able to identify and use empirical evidence to describe/explain and predict natural phenomena through application of the scientific method; and use scientific principles to design, evaluate, and implement strategies to answer open-ended questions.
        iv. Knowledge of the Physical World: Students will be able to describe some of the major concepts in science to explain natural phenomena; and evaluate the quality of scientific information on the basis of methods used to generate it.
    b. Solutions through Science category-specific list of criteria follow.
2. Course Syllabus
3. Example Assignment(s)
4. Example Assessment(s)

Minimum Rubric Evaluation Criteria for SLOs (per GEOC Standing Rules):

Critical Thinking and Reasoning	Analyze evidence to support or create interpretations, arguments, or claims
	Identify and analyze the connection between evidence and claims
	Evaluate the strength and weaknesses of conclusions and opinions
	Determine the scope of evidence needed for original arguments

Quantitative Reasoning	Interpret models and/or solve quantitative problems from different contexts with real-world relevance
	Create reasonable arguments supported by quantitative evidence
	Communicate reasonable arguments supported by quantitative evidence in effective formats

Scientific Reasoning	Identify and use empirical evidence to describe/explain natural phenomena through application of the scientific method
	Identify and use empirical evidence to predict natural phenomena through application of the scientific method
	Use scientific principles to design strategies to answer open-ended questions
	Use scientific principles to evaluate strategies to answer open-ended questions
	Use scientific principles to implement strategies to answer open-ended questions

Knowledge of the Physical World	Describe some of the major concepts in science to explain natural phenomena
	Evaluate the quality of scientific information on the basis of methods used to generate it

SOLUTIONS THROUGH SCIENCE CATEGORY-SPECIFIC MATERIALS/RESPONSES:

1. Complete the Criteria Worksheet, providing evidence of student engagement with SLOs and descriptions of assessment types (150-word limit for each response).

Note: These tables are provided here for planning purposes. The last three columns will be available as fillable fields in Curriculog.

Criteria Worksheet: Solutions through Science

SLO: Critical Thinking and Reasoning			
Complete at the least the FIRST FOUR of the following			
Criteria: Students will …	**Evidence of Student Engagement**	**Assessment Types**	**Description**
a) Analyze evidence to support or create interpretations, arguments, or claims			
b) Identify and analyze the connection between evidence and claims			
c) Evaluate the strength and weaknesses of conclusions and opinions			
d) Determine the scope of evidence needed for original arguments			
e) Demonstrate a variety of scientific principles empirically and the ways scientists from a particular discipline conduct research.			
f) Analyze the effective use of a scientific method through exploration of a given subject or topic.			
g) Explore alternative solutions to complex questions through critical evaluation of an investigation.			

h) Critically evaluate quantitative or qualitative products (tables, graphs, mathematical equations) and identifies/acknowledges the limitations and capabilities of knowledge.			
i) Comprehensively analyze evidence before they create, critique, or accept an opinion, conclusion, or determine a need for further investigation			

SLO: Quantitative Reasoning			
Complete at the least the FIRST THREE of the following			
Criteria: Students will …	**Evidence of Student Engagement**	**Assessment Types**	**Description**
a) Interpret models and/or solve quantitative problems from different contexts with real world relevance.			
b) Create reasonable arguments supported by quantitative evidence (e.g., using words, tables, graphs, and/or mathematical equations).			
c) Communicate reasonable arguments supported by quantitative evidence (e.g., using words, tables, graphs, and/or mathematical equations).			
d) Demonstrate a variety of mathematical principles and the methods of data analysis.			
e) Students will apply or demonstrate the use of quantitative analyses in a variety of different contexts to construct explanations and/or solve problems.			

SLO: Scientific Reasoning			
Complete at the least the FIRST FIVE of the following			
Criteria: Students will …	**Evidence of Student Engagement**	**Assessment Types**	**Description**
a) Identify and use empirical evidence to *describe/explain* natural phenomena through application of a scientific method.			
b) Identify and use empirical evidence to *predict* natural phenomena through application of a scientific method.			
c) Use scientific principles to *design* strategies to answer open-ended questions.			

d) Use scientific principles to *evaluate* strategies to answer open-ended questions.			
e) Use scientific principles to *implement* strategies to answer open-ended questions.			
f) Critically evaluate scientific arguments and identify the limits of scientific knowledge.			
g) Explore complex questions and identify how they impact or are impacted by external issues (political, economic, or ethical).			
h) Solve or demonstrate resolutions to complex questions or problems requiring the application of scientific concepts.			
i) Communicate scientific ideas effectively.			

SLO: Knowledge of the Physical World			
Complete at the least the FIRST THREE of the following			
Criteria: Students will …	**Evidence of Student Engagement**	**Assessment Types**	**Description**
a) Describe some of the major concepts in science to explain natural phenomena.			
b) Evaluate the quality of scientific information on the basis of methods used to generate it.			
c) Use qualitative and/or quantitative analyses to draw inferences or conclusions from data.			
d) Explore complex questions and identify how they impact or are impacted by external issues (political, economic, or ethical).			

COURSE PROPOSAL EVALUATION CRITERIA AND RUBRICS

GEOC Advisory Subcommittee members will use the following rubrics when reviewing and providing feedback on faculty submissions for Solutions through Science.

CRITICAL THINKING AND REASONING: COURSE MUST MEET **AT LEAST THE FIRST FOUR** OF THE FOLLOWING		
Criteria: Students will …	**Course Meets Criteria?**	**Comments**
a) Analyze evidence to support or create interpretations, arguments, or claims	❑ **Yes** ❑ **No** ❑ **Unclear**	
b) Identify and analyze the connection between evidence and claims	❑ **Yes** ❑ **No** ❑ **Unclear**	
c) Evaluate the strength and weaknesses of conclusions and opinions	❑ **Yes** ❑ **No** ❑ **Unclear**	
d) Determine the scope of evidence needed for original arguments	❑ **Yes** ❑ **No** ❑ **Unclear**	
e) Demonstrate a variety of scientific principles empirically and the ways scientists from a particular discipline conduct research.	❑ **Yes** ❑ **No** ❑ **Unclear**	
f) Analyze the effective use of a scientific method through exploration of a given subject or topic.	❑ **Yes** ❑ **No** ❑ **Unclear**	
g) Explore alternative solutions to complex questions through critical evaluation of an investigation.	❑ **Yes** ❑ **No** ❑ **Unclear**	
h) Critically evaluate quantitative or qualitative products (tables, graphs, mathematical equations) and identifies/acknowledges the limitations and capabilities of knowledge.	❑ **Yes** ❑ **No** ❑ **Unclear**	
i) Comprehensively analyze evidence before they create, critique, or accept an opinion, conclusion, or determine a need for further investigation	❑ **Yes** ❑ **No** ❑ **Unclear**	
Total number of SCIENTIFIC REASONING criteria met by course proposal:		**/9**

QUANTITATIVE REASONING: COURSE MUST MEET **AT LEAST THE FIRST THREE** OF THE FOLLOWING		
Criteria: Students will …	**Course Meets Criteria?**	**Comments**
a) Interpret models and solve quantitative problems from different contexts with real world relevance.	❑ **Yes** ❑ **No** ❑ **Unclear**	
b) Create reasonable arguments supported by quantitative evidence (e.g., using words, tables, graphs, and/or mathematical equations).	❑ **Yes** ❑ **No** ❑ **Unclear**	
c) Communicate reasonable arguments supported by quantitative evidence (e.g., using words, tables, graphs, and/or mathematical equations).	❑ **Yes** ❑ **No** ❑ **Unclear**	
d) Demonstrate a variety of mathematical principles and methods of data analysis.	❑ **Yes** ❑ **No** ❑ **Unclear**	
e) Students will apply or demonstrate the use of quantitative analyses in a variety of different contexts to construct explanations and/or solve problems.	❑ **Yes** ❑ **No** ❑ **Unclear**	
Total number of QUANTITATIVE REASONING criteria met by course proposal:		**/5**

SCIENTIFIC REASONING: COURSE MUST MEET **AT LEAST THE FIRST FIVE** OF THE FOLLOWING		
Criteria: Students will …	**Course Meets Criteria?**	**Comments**
a) Identify and use empirical evidence to *describe/explain* natural phenomena through application of a scientific method.	❑ **Yes** ❑ **No** ❑ **Unclear**	
b) Identify and use empirical evidence to *predict* natural phenomena through application of a scientific method.	❑ **Yes** ❑ **No** ❑ **Unclear**	
c) Use scientific principles to *design* strategies to answer open-ended questions.	❑ **Yes** ❑ **No** ❑ **Unclear**	
d) Use scientific principles to *evaluate* strategies to answer open-ended questions.	❑ **Yes** ❑ **No** ❑ **Unclear**	
e) Use scientific principles to *implement* strategies to answer open-ended questions.	❑ **Yes** ❑ **No** ❑ **Unclear**	
f) Critically evaluate scientific arguments and identify the limits of scientific knowledge.	❑ **Yes** ❑ **No** ❑ **Unclear**	
g) Explore complex questions and identify how they impact or are impacted by external issues (political, economic, or ethical).	❑ **Yes** ❑ **No** ❑ **Unclear**	

h) Solve or demonstrate resolutions to complex questions or problems requiring the application of scientific concepts.	❑ **Yes** ❑ **No** ❑ **Unclear**	
i) Communicate scientific ideas effectively.	❑ **Yes** ❑ **No** ❑ **Unclear**	
Total number of SCIENTIFIC REASONING criteria met by course proposal:		**/9**

KNOWLEDGE OF THE PHYSICAL WORLD: COURSE MUST MEET **AT LEAST THREE INCLUDING THE FIRST TWO** OF THE FOLLOWING		
Criteria: Students will …	**Course Meets Criteria?**	**Comments**
a) Describe some of the major concepts in science to explain natural phenomena.	❑ **Yes** ❑ **No** ❑ **Unclear**	
b) Evaluate the quality of scientific information on the basis of methods used to generate it.	❑ **Yes** ❑ **No** ❑ **Unclear**	
c) Use qualitative and/or quantitative analyses to draw inferences or conclusions from data.	❑ **Yes** ❑ **No** ❑ **Unclear**	
d) Explore complex questions and identify how they impact or are impacted by external issues (political, economic, or ethical).	❑ **Yes** ❑ **No** ❑ **Unclear**	
Total number of KNOWLEDGE OF THE PHYSICAL WORLD criteria met by course proposal:		**/4**

COURSE DESCRIPTION & OBJECTIVES

Based on the course syllabus, assign an appropriate rating to course description and objectives in relation to the required Student Learning Outcomes.

5	4	3	2	1
Description and objectives show an exceptional emphasis on the required student learning outcomes.	Description and objectives show a clear emphasis on the required student learning outcomes.	Description and objectives adequately address the required student learning outcomes.	Description and objectives make limited reference to the required student learning outcomes.	Description and objectives make no reference to the required student learning outcomes.

COURSE FOCUS

Based on the course syllabus, assign an appropriate rating to the course focus by determining what percentage of the course content deals with the required Student Learning Outcomes.

5	4	3	2	1
90-100% of the course appears to be related to the student learning outcomes	80-89% of the course appears to be related to the student learning outcomes	70-79% of the course appears to be related to the student learning outcomes	50-69% of the course appears to be related to the student learning outcomes	0-49% of the course appears to be related to the student learning outcomes
100% 90%		80%	70%	0% 0%

EVIDENCE OF STUDENT LEARNING				
Based on the following Criteria Checklist, assign an appropriate rating to course assessments in relation to the required Student Learning Outcomes.				
5 Assessments far exceed the minimum requirements for ensuring student learning outcomes.	4 Assessments exceed the minimum requirements for ensuring student learning outcomes.	3 Assessments meet the minimum requirements for ensuring student learning outcomes.	2 Assessments do not meet the minimum requirements for ensuring student learning outcomes.	1 Assessments need significant improvement to ensure student learning outcomes.

Final remarks and decision, to be completed by the subcommittee:

- ❑ Accept the course, as submitted, for Solutions through Science.
- ❑ Suggested revisions to meet Solutions through Science requirements:

Salisbury UNIVERSITY