Engineering and Science Education Program (ESEP)
Additional Subjects

PROGRAM STANDARD:

The learner demonstrates understanding of basic Science concepts within the framework of Science, Technology and Society in order to think innovatively/creatively and make informed decisions to enhance the integrity and wellness of the human person, protect the environment and conserve resources in order to sustain quality life.

GENERAL STANDARDS

Grade 7	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
ESEP					
The learner demonstrates understanding of fundamental concepts and processes in Environmental Science and Computer Technology as deepened by other disciplines to analyze/solve problems critically, think innovatively/creatively, and make informed decisions to enhance	The learner demonstrates understanding of basic concepts and processes in Biotechnology as deepened by other disciplines, to analyze/solve problems critically, think innovatively/creatively, and make informed decisions to enhance the integrity and wellness of the human	The learner demonstrates understanding of basic concepts and processes in Consumer Chemistry and Advanced Statistics as deepened by other disciplines to analyze/solve problems critically, think innovatively/creatively, and make informed decisions to enhance the integrity and wellness of the human person, protect the environment	The learner demonstrates understanding of basic concepts and processes in Electronics and Research as deepened by other disciplines to analyze/solve problems critically, think innovatively/creatively, and make informed decisions to enhance the integrity and wellness of the human person, protect the environment and conserve resources	The learner demonstrates understanding of the special concepts and processes in Introduction to Genetics, Thermodynamics and Linear Algebra as deepened by other disciplines to analyze/solve problems critically, think innovatively/creatively, and make informed	The learner demonstrates understanding of the special concepts and processes in Fundamentals of Biochemistry and Basic Computer Programming as deepened by other disciplines to analyze/solve problems critically, think innovatively/creatively, and make informed

the integrity and wellness of the human person, protect the environment, and conserve resources in order to sustain quality life.	person, protect the environment and conserve resources in order to sustain quality life.	and conserve resources in order to sustain quality life.	in order to sustain quality life.	decisions to enhance the integrity and wellness of the human person, protect the environment and conserve resources in order to sustain quality life.	decisions to enhance the integrity and wellness of the human person, protect the environment and conserve resources in order to sustain quality life.

Engineering and Science Education Program (ESEP)
Additional Subjects

Grade 8

GENERAL STANDARD:
The learner demonstrates understanding of basic concepts and processes in Biotechnology as deepened by other disciplines, to analyze/solve problems critically, think innovatively/creatively, and make informed decisions to enhance the integrity and wellness of the human person, protect the environment and conserve resources in order to sustain quality life.

Additional Subject 1

Biotechnology

Grade 8	STANDARD		ESSENTIAL/ENDURING		Product / Performance Task	Evidence at the Level of Understanding	Evidence at the Level of Performance
	Content	Performance	Understanding/s	Question/s			
Quarter 1A The Science of Biotechnology	The learner demonstrates understanding of cellular structures and functions used in the livelihood, promotion of food production and health.	Learners, individually or in groups, develop innovative, marketable, replicable and cost-effective products resulting from understanding of cellular structures and functions.	Understanding of cellular structures and functions can be used in promoting livelihood, food production and health.	How can understanding of cellular structures and functions be used?	Innovative, marketable, replicable, cost-effective products resulting from understanding of cellular structures and functions	**EXPLANATION** Describe cellular structures and their functions. Criteria: a. Thorough discussing completely how cell structures work) b. Justifiable (providing depth	**Evidence at the Level of Performance** Performance assessment of the product based on the following criteria: • Innovativeness/ creativity • Marketability • Replicability of the

	Learners will know: I. Cellular Structures II. Cellular Functions A. Transport of materials B. Cell division C. ATP production	**Learners will be able to:** 1. Discuss the main parts and organelles of the cell. 2. Explain different cell functions.				and breadth of scientific reasoning) c. Clear (expressing with clarity scientific thoughts in written or oral form) **INTERPRETATION** Illustrate how cell maintains its life through a creative story. Criteria: a. Meaningful (giving the significance of its parts in keeping it alive.); b. Illustrative (discussing accurate data/information that show details of the significance); **APPLICATION** Make a project proposal for developing product(s) based on the knowledge	production processes • Cost Effectiveness • Benefits to one's health and the environment

						about cell. Criteria: a. Appropriate (proposing ways or approaches how the knowledge of cells can be used/adapted in relation to one's life) b. Practical (suggesting how these ways or approaches can be done easily) c. Efficient (expounding how the proposed ways or approaches will employ the productive use of time and resources) d. Effective (achieving the desired result in using the knowledge of the cell) **PERSPECTIVE** Compare benefits derived from different	

						commercially available products developed through understanding of cell. Criteria: a. Insightful (providing comparison of the health benefits derived from the products) b. Credible (citing authoritative sources of information) **EMPATHY** Assume what a one would feel about the use of products (developed based on understanding of cell) to promote livelihood, food production and health. Criteria: a. Perceptive (recognizing the dilemma or problem that one faces in using	

						said products) b. Responsive (exhibiting how one will react to this situation) **SELF-KNOWLEDGE** Reflect how one can promote livelihood, food production and health based on one's understanding of cell structures and functions. Criteria: a. Reflective (becoming aware on what one can do to promote livelihood, food production and health based on this understanding) b. Responsive (reacting positively as a result of developing this awareness)	

Quarter 1B **Biotechniques** Biological Techniques, Procedures and Methods	Learners will demonstrate understanding of biological techniques, procedures and methods as tool for preparation of biological specimen and instruments for field and laboratory activities. **Learners will know:** I. Proper Use of Laboratory Apparatus / Equipment • Compound and Dissecting Microscope • Balance • Pipette • Burette • Autoclave II. Biological Techniques, Procedures and Methods 1. Preparation or Reagents 2. Aseptic Technique 3. Preparation of Microbiological Media 4. Sterilization and Disinfection 5. Preparation of Biological Specimen	Learners manifest understanding of biological techniques, procedures and methods as preparatory tool for preparation of biological specimen and instruments for field and laboratory activities. **Learners will be able to:** 1. Properly use laboratory apparatus/equipments 2. Perform biological techniques, procedures and methods.	Biological techniques, procedures and methods are tools for preparation of biological specimen and instruments for field and laboratory activities.	When do biological techniques, procedures, and methods become valuable?	Learners in group will prepare a laboratory kit for the preparation of biological specimens and instruments	**EXPLANATION** Explain the role of biological techniques, procedures, and methods in preparation of biological specimens and instruments. **Criteria:** Accurate Justified **INTERPRETATION** Analyze the role of different biological techniques in preparation of biological specimen. **Criteria:** Meaningful Illustrative **APPLICATION** Identify and compare three different processes or techniques for preparation of specimen. **Criteria:** Effective Efficient	Performance assessment of learners' output based on the following criteria: 1. Comprehensive 2. Systematic 3. Insightful

						PERSPECTIVE Compare and contrast old and modern biological techniques. **Criteria:** Insightful Plausible **EMPATHY** Imagine you are a researcher who needs a longer time to observe specimen samples. Discuss your plans of preserving your specimen for a longer period of time. **Criteria:** Sensitive perceptive **SELF-KNOWLEDGE** Realize the impact of materials used for preparation of specimen in health and safety. **Criteria:** Self-aware Self-adjusting	

Quarter 2-A **Introduction to Biotechnology**	The learner demonstrates understanding of biotechnology as used in improving certain techniques or practices and developing beneficial products **Learners will know:** Introduction to Biotechnology -Traditional Biotechnology -Modern Biotechnology Commonly Used Microbes in Biotechnology	Learners, individually or in groups, use certain techniques or practices to produce innovative, market viable dependable and profitable products based on their understanding of biotechnology. **Learners will be able to:** 1. Differentiate traditional biotechnology and modern biotechnology 2. Discuss techniques or practices used in traditional biotechnology (cheese, toyo, vinegar making, nata de coco production etc,) 3. identify commonly used microbes in biotechnology.	Understanding of biotechnology can be used in improving certain techniques or practices and developing beneficial products.	How can understanding of biotechnology be used?	Use of certain techniques or practices to produce innovative, market viable, dependable and profitable products based on the understanding of biotechnology.	**EXPLANATION** Explain the difference between traditional biotechnology and modern biotechnology Criteria: a.Thorough (discussing completely how traditional biotechnology and modern biotechnology); b.Justifiable (providing depth and breadth of scientific reasoning); c.Clear (expressing with clarity scientific thoughts in written or oral form). **INTERPRETATION**	**Evidence at the Level of Performance** Performance assessment of the product based on the following criteria: • Innovativeness/ creativity • Marketability • Replicability of the production processes • Cost-effectiveness • Benefits to one's health and the environment

						Make sense of the importance of traditional breeding techniques for plants and animals to improve food production. Criteria: a.Meaningful b. Illustrative **APPLICATION** Make a project proposal in developing product(s) based on the knowledge that biotechnology can be used to improve life. Criteria: a. Appropriate (proposing ways or approaches how the knowledge of biotechnology can be used/adapted in relation to one's life); b.Practical (suggesting how	

						these ways or approaches can be done easily); c.Efficient (expounding how the proposed ways or approaches will employ the productive use of time and resources); d.Effective (achieving the desired result in using the knowledge of the cell). **PERSPECTIVE** Compare benefits derived from different commercially available products developed from understanding of biotechnololgy. Criteria: a.Insightful (providing comparison of the health benefits derived from the products); b.Credible (citing	

						authoritative sources of information). **EMPATHY** Assume what one would feel about the use of products developed based on understanding of biotechnology. Criteria: a.Perceptive (recognizing the dilemma or problem that one faces in using said products); b. Responsive (exhibiting how one will react to this situation). **SELF-KNOWLEDGE** Reflect how one can develop innovative, marketable, replicable and cost-effective products resulting from understanding of biotechnology.	

						Criteria: a. Reflective (becoming aware on what one can do to develop innovative, marketable, replicable and cost-effective products based on this understanding); b. Responsive (reacting positively as a result of developing this awareness).	
Quarter 2B **Molecular Genetics**	Learners demonstrate understanding of DNA to respect diversity of life and promote overall wellness. **Learners will know:** I. DNA History II. DNA Structure and Chemistry III. Central Dogma -replication -transcription -translation	Learner makes a reflective journal about DNA that respect diversity of life and promote overall wellness **Learners will be able to:** 1. Analyze the vital role of DNA, RNA and proteins in the transmission of hereditary traits.	Understanding of DNA is important to respect diversity of life and promote overall wellness.	Where does understanding of Deoxyribose Nucleic Acid (DNA) lead to?	Reflective journal about DNA that respect diversity of life and promote overall wellness.	**EXPLANATION** Explain how the structure and function of DNA connected to all cellular activities? Criteria: a. Thorough (explaining how the structure and function of DNA connected to all cellular activities.) b. Clear (expressing with clarity the thought in oral or written form); c. Justifiable (providing different	Performance assessment of learners' output based on the following criteria: 1. Comprehensive 2. Systematic 3. Insightful

	IV. Mutation	2. Explain how mutation in DNA affects an individual				examples and concrete situations). **INTERPRETATIO N** What are the implications of a sequenced change in DNA? Criterion a. Meaningful (giving brief yet substantial discussion on the implication of a sequenced change in DNA). **APPLICATION** How might transcription and translation help us to produce a protein? Criteria: a. Appropriate (using applicable concept/s on DNA); b. Practical (discussing how the proposed solution can be done with ease).	

						PERSPECTIVE Analyze the role of DNA in the transmission of hereditary traits. Criteria: a. Insightful b. Credible c. Reflective of critical thinking **EMPATHY** Assume the role of a parent with a son/daughter with a genetic disorder. Criteria: a. Perceptive b. Receptive **SELF-KNOWLEDGE** **Recognize** What one can do based on understanding of DNA. Criteria: a. a. Reflective (becoming aware that this	

						understanding can influence a person's way of thinking, belief, attitude or behavior); b. Responsive (showing positive reaction based on this understanding).	
Quarter 3 Genetic Engineering	Learners demonstrate understanding of genetic engineering and its corresponding benefits to society. **Learners will know:** I. Tools of genetic engineering II. Recombinant DNA Technology .	The learner makes informed decisions relative to genetic engineering with due consideration to its benefits to society. **Learners will be able to:** 1. describe the different tools use in genetic engineering. 2. discuss how the genetic materials of organisms are manipulated. 3. outline the main steps in recombinant DNA technology	Understanding the science of genetic engineering is important when making informed decisions with due considerations to its benefits to society.	To what extent genetic engineering useful? Explain.	Using one's understanding of genetic engineering in making informed decision with due considerations to its benefits to society.	EXPLANATION Describe in your own words the significance of advances in genetic engineering Criteria a. Thorough (explaining completely the significance of advances in genetic engineering) b. Clear (expressing with clarity the scientific thought in oral or written form) c. Justifiable (providing depth and breadth of scientific reasoning)	Performance assessment of learner's decision based on the following criteria: 1. Informed; 2. reflective of the usefulness of genetic engineering to society.

						INTERPRETATIO N Evaluate the advances in genetic engineering. Criteria a. Meaningful (giving substantial insights about genetic engineering) b. Illustrative APPLICATION Use practically the information gained from the study of genetic engineering Criteria a. Appropriate b. Practical c.Efficient d.Effective PERSPECTIVE Infer on the risks and cost effectiveness of efforts done in advancing genetic engineering	

						Criteria a. Insightful b. Credible c. Reflective of critical thinking EMPATHY Role play how scientist might feel about using technologies arising from genetic engineering. a. Perceptive b. Receptive c. Responsive SELF-KNOWLEDGE Be aware on how advances in genetic engineering help one become more objective and appreciative of the wonders of nature. Criteria a. Reflective b. Responsive	

Quarter 4 **Application of Biotechnology**	The learner demonstrates understanding of the applications of biotechnology to make informed decision in promoting good health, improving livelihood, safe environment and making intelligent and moral choices. **Learners will know:** **I. Applications of Biotechnology** a. Biotechnology and Health b. Biotechnology and Agriculture c. Biotechnology and Industry d. Biotechnology and Environment	The learner manifests understanding of the applications of biotechnology by making informed decision to promote good health, improve livelihood, safe environment and making intelligent and moral choices. **Learners will be able to:** 1. Cite some application of DNA technology in health, agriculture, industry and environment	Applications of biotechnology becomes valuable when used in making informed decisions to promote good health, improve livelihood, safe environment and making intelligent and moral choices.	When does applications of biotechnology become valuable?	Manifest understanding of the application of biotechnology by making informed decision in choosing matters pertaining to promotion of good health, improvement of livelihood, safe environment and making intelligent and moral choices.	**EXPLANATION** Explain how modern biotechnology works. Criteria: a. Thorough (explaining how the genetic makeup of plants and animals can be modified to improve product quality, nutritional content, and economic benefits); b. Clear (expressing with clarity the thought in oral or written form); c. Justifiable (providing different examples and concrete situations). **INTERPRETATION** Make sense of the importance of recombinant DNA technology in health, agriculture,	Performance assessment of learner's decision based on the following criteria: 2. Informed; 3. Involved matters pertaining to a. promotion of good health b. improvement of livelihood c. safe environment d. making intelligent and moral choices.

						industry and environment. Criterion a. Meaningful (giving brief yet substantial discussion on the importance of recombinant DNA technology in health, agriculture, industry and environment. **APPLICATION** Propose how biotechnology can be applied in addressing certain situations or solving some problems (e.g. crimes) Criteria: a. Appropriate (using applicable concept/s on biotechnology in addressing certain situations or solving problems); b. Practical (discussing how	

						the proposed solution can be done with ease). **PERSPECTIVE** Infer on the cost effectiveness of applying biotechnology in health, agriculture, industry and environment. . Criteria: a. Insightful (drawing lessons or insights deduced from the application of biotechnology in health, agriculture, industry and environment. b. Credible (using authoritative sources of information in biotechnology); c. Reflective of critical thinking (combining research, understanding of historical context;	

						developing higher order thinking skills while making an inference) . **EMPATHY** Assume the role of a geneticist who applies DNA technology in studies or experiments while upholding respect for life and high ethical standards. Criteria: a. Perceptive (accepting that geneticists may be prone to biases as they apply DNA technology in their studies or experiments); b. Receptive (accepting readily/ willingly that a geneticists should adhere to uphold the value of respect for life and high ethical standards while applying	

						biotechnology in studies or experiments). **SELF-KNOWLEDGE** Be aware that one is capable of making intelligent and moral choices regarding daily decisions based on understanding of biotechnology. Criteria: a. Reflective (becoming aware how to make intelligent and moral choices regarding daily decisions based on understanding of biotechnology); b. Responsive (reacting positively as a result of redirecting/ changing one's thought or view).	