
NATIONAL EXAMS DECEMBER 2016

04-Env-B1, Environmental Assessment and Management Systems

3 hours duration

NOTES

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
2. This is a CLOSED BOOK EXAM with a 2-sided ($8\frac{1}{2}'' \times 11''$) AID SHEET prepared by the candidate allowed.
3. The candidate may use one of two calculators, the Casio or Sharp approved models. Note that you must indicate the type of calculator being used. Write the name and model designation of the calculator on the first inside left hand sheet of the exam work book.
4. Any five(5) questions constitute a complete paper. Only the first five(5) answers as they appear in your work book(s), will be marked.
5. Each question is equally weighted at twenty (20) points for a total of a possible one-hundred (100) points for a complete paper.

Problem 1

Provide answers to the following questions related to *resource problems and design* with consideration of *ecological, economic, demographic and social dimensions*:

- (10) (i) It has been advocated that water management will be a major challenge due to the global phenomena of climate change. Some of the key issues of water management include: (1) ensuring an adequate supply (groundwater or surface water source); (2) potable water distribution; (3) water treatment; (4) wastewater treatment; (5) water conservation and (6) highly treated wastewater reuse. Considering any one of the key issues above, provide one (1) example where environmental engineers may optimize engineering designs, to ensure long term sustainability, by integrating ecological, economic, demographic and social issues. Use a table to organize your answer.
- (10) (ii) Provide three (3) key points of a strategy whereby engineers may successfully integrate both ecological and economic dimensions in their engineering designs to address an important resource problem. Briefly identify and describe a key resource problem as part of your answer.

Problem 2

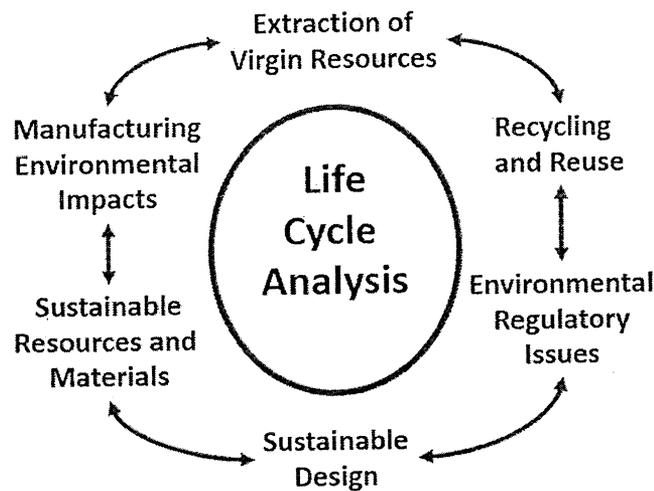
Provide answers to the following questions related to *techniques to integrate knowledge and define policy* and *risk analysis*:

- (10) (i) Explain three (3) techniques to integrate various sources of knowledge to define environmental policy. Your techniques should ensure that interdisciplinary knowledge would be reflected in the final policy adopted.
- (10) (ii) Explain how risk analysis methods may improve regulations to control groundwater taking permits in areas where groundwater aquifers are under high demand by the industrial, residential and farming communities. In your explanation, include three (3) important aspects of risk analysis.

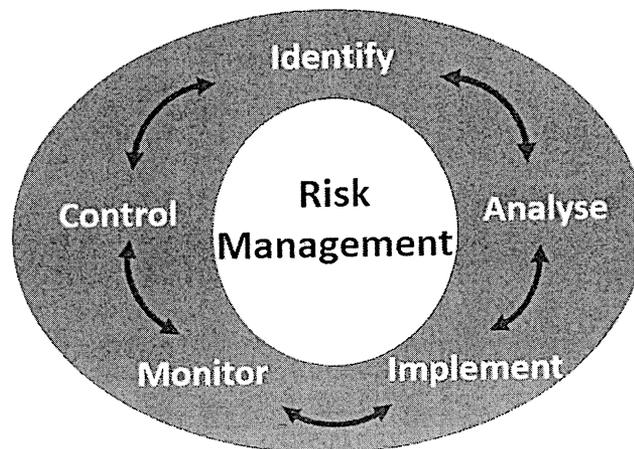
Problem 3

Provide answers to the following questions related to *life cycle analysis (LCA)* and *risk management (RM)*:

- (10) (i) Using the diagram below explain how using a life cycle analysis (LCA) makes sense from an economic and as well as an environmental perspective. In your explanation, identify three (3) important areas that need to be addressed from an engineering design perspective.



- (10) (ii) Using the figure below, provide an illustrative example to explain how using risk management (RM) analysis can help reduce environmental impacts. As part of your explanation, include three (3) important areas that need to be addressed in the RM approach.



Problem 4

Answer the following questions related to *environmental audits, geographical information systems (GIS)* and *environmental management systems (EMS)*:

- (7) (i) Briefly explain three (3) key steps in conducting an environmental audit and three (3) expected environmental benefits.
- (6) (ii) Provide three (3) ways in which GIS can assist environmental engineers to locate, design and operate a new landfill site for a large municipality towards achieving a maximum operating period.
- (7) (iii) In order to address environmental issues, the manufacturing industry has recently increased the use EMS. Provide three (3) ways in which sustainability may be integrated with manufacturing within an EMS.

Problem 5

Provide answers to the following questions related to *principles of sustainable development, design of controlled environments* and *protection of natural resources for sustainable development*:

- (6) (i) Briefly explain three (3) key principles of sustainable development. You may select an example of your choice to answer this question.
- (7) (ii) Explain three (3) key differences between design principles for controlled environments versus natural environments. You may select an example of your choice to answer this question and a matrix may be useful to organize your answer.
- (7) (iii) Sustainable development has been defined as, "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Select one (1) industrial sector of your choice and describe three (3) ways in which they may comply with the definition of sustainable development.

Problem 6

Provide answers to the following questions related to following areas: *environmental impact assessment applied to solid waste management, effluent control and air pollution control*:

- (7) (i) Describe three (3) key issues in an environmental impact assessment that will help the municipal engineers to minimize environmental impacts associated with the operation of a solid waste separation and transfer station. Assume that the transfer station serves a large municipality that operates a large landfill site.
- (7) (ii) Combined sanitary sewer overflows (CSOs) are a major environmental concern that commonly occur at pumping stations in municipalities that use combined sewers and with high infiltration and inflow. Briefly provide three (3) possible solutions to reduce the quantity of CSOs in such systems.
- (6) (iii) Provide an example of a technical solution to reduce the discharge of industrial volatile organic compounds (VOCs). Assume that the VOCs are being discharged from an industrial park from various single sources located close to a residential community.

Problem 7

Provide answers to the following questions related to *analysis of environmental impacts using technical and non-technical parameters and applicable federal, territorial or provincial environmental legislation*:

- (10) (i) Describe the use of three (3) indicators from an environmental impact analysis to show the impacts on the hydrosphere due to a large scale hydro electric operation in northern Alberta. Consider that potential valuable water resources and natural habitats may be impacted. In your description, briefly compare the relative environmental effectiveness of technical versus non-technical approaches. A matrix to organize your answer is recommended.
- (10) (ii) Provide one (1) example, of a federal, territorial or provincial environmental legislation framework and explain how it has been applied to promote environmental sustainability. In your example explain the use of three (3) important measures that have made the legislative framework successful.

Marking Scheme

1. (i) 10, (ii) 10 marks, 20 marks total
2. (i) 10, (ii) 10 marks, 20 marks total
3. (i) 10, (ii) 10 marks, 20 marks total
4. (i) 7, (ii) 6, (iii) 7 marks, 20 marks total
5. (i) 6, (ii) 7, (iii) 7 marks, 20 marks total
6. (i) 7, (ii) 7, (iii) 6 marks, 20 marks total
7. (i) 10, (ii) 10 marks, 20 marks total