AFRICAN ECONOMIC RESEARCH CONSORTIUM

Collaborative PhD Programme in Economics for Sub-Saharan Africa

COMPREHENSIVE EXAMINATIONS IN CORE AND ELECTIVE FIELDS
FEBRUARY 19 – MARCH 10, 2021

ENVIRONMENTAL ECONOMICS

Time: 08:00 – 11:00 GMT   **Date: Wednesday, March 10, 2021**

INSTRUCTIONS:

Answer a total of FOUR questions: ONE question from Section A, ONE question from Section B, and TWO questions from Section C, one of which **MUST** be either **Question 5** or **Question 6**.

The sections are weighted as indicated on the paper.

SECTION A: (15%)

Answer only ONE Question from this Section

Question 1

(a)   What are the causes and policy options available to deal with an open-access exploitation of biodiversity?   (**8 Marks**)

(b)   Many have argued that the problem of climate change which the world is battling with today is a classic example of the prisoners' dilemma game. Assume we have N=12 identical countries who have to choose between two strategies-mitigating greenhouse emissions and business as usual –doing nothing. Assume further that for each of the 12 countries, it cost 6 units to abate a ton of CO_2 but conveys a benefit of 4 to the abating country and all other countries. What will be the payoff matrix for each of the countries? (Explain briefly).

                                                                                                                (**7 Marks**)

Question 2

(a) Describe each of the following biases and indicate their relevance to environmental valuation:

    (i)   Strategic bias. **(3 Marks)**

    (ii) Hypothetical bias. **(3 Marks)**

    (iii) Starting point bias. **(3 Marks)**

(b) Explain four differences between Choice Experiment and Contingency Valuation Method
(6 Marks)

SECTION B: (25%)
Answer only ONE Question from this Section

Question 3

(a) With the help of examples distinguish between flow pollution damage and stock pollution damage. **(4 Marks)**

(b) With the aid of a diagram, show that emission charge encourages innovation in pollution abatement technology. **(7 Marks)**

(c) Assume that the demand function for water in a town can be described as $P = 25 - 0.04Q$, with average cost (AC) $AC = 0.5Q$, and marginal cost (MC), $MC = Q$, where P is price in thousands of dollars and Q is the amount of water in hundreds of gallons.

    (i)   Calculate the consumers' and producers' surplus if the town wants to price water at average cost. **(4 Marks)**

    (ii) Calculate the consumers' and producers' surplus if the town wants to price water at marginal cost. **(4 Marks)**

    (iii) What would be your advice to the town authority to supply water on sustainable basis?
(3 Marks)

    (iv) Would average pricing affect social efficiency? **(3 Marks)**

Question 4

The Kakum National Park in Ghana is one of the well-known Parks in the world with its mammal and bird species and an incredible 'walkway' that permits visitors to have a feel of a pristine forest. Currently, the gate fee to the park is free. An investor is interested in undertaking mining in the area since the soil contains some mineral. As an Environmental Economist, the government of Ghana has asked you to estimate the value of the park. Using the Zonal Travel Cost method, your fieldwork provided the following data:

ZONE	VISITS	POPULATION (IN 0000)	TRAVEL COST (From Zone to Kakum Park)
1	1600	300	15
2	4900	900	20
3	1250	350	25
4	4600	1600	30
5	3500	2366	35
6	2500	1550	40

(a) Using the information above, estimate the linear Trip Generation Function (TGF) for Kakum National Park. **(7 Marks)**

(b) With the help of the TGF, estimate the surrogate demand function if the gate fee increases from $0 to $15 in steps of $5. **(8 Marks)**

(c) Sketch the surrogate demand function. **(2 Marks)**

(d) Using the surrogate demand for Kakum National Park, estimate the total consumer surplus. **(4 Marks)**

(e) Assume there is an improvement in the quality of the park (resulting from the provision of hotels, restaurants tour guides, etc.), and as a result, the demand for the park increases. How will you value the change in the value of the park as a result of this improvement? (Use sketches to illustrate your answer). **(4 Marks)**

SECTION C: (60%)

Answer TWO Questions from this Section,

AT LEAST one of which MUST be Either Question 5 or Question 6

Question 5

(a)   Explain what ecosystem services are, citing an example in each case.   **(10 Marks)**

(b)   How can payment for ecosystem services be used as a policy instrument for biodiversity conservation?   **(10 Marks)**

(c)   What are the inherent limitations in applying it in the African context?   **(10 Marks)**

Question 6

Assume that country **A** has discovered an oil deposit of total quantity 40 bbl and wants to allocate the resource for two periods using a discount rate of 15%. The willingness to pay function (demand) and marginal extraction costs remain constant in both periods where $P = 20 - 0.5q$ with marginal extraction cost (MEC) equals \$5 per barrel. Based on this information and assuming a *dynamically efficient* resource allocation setting:

(a)   How much resource should be allocated to current period?   **(6 Marks)**

(b)   How much should be allocated to the future period?   **(6 Marks)**

(c)   What is the net social benefit for the two periods?   **(8 Marks)**

(d)   With the demand for the oil remaining unchanged, could a decline in MEC by 40% due to technological change affect efficiency in allocations? What can you conclude from your answer on the effect of technological change? Please indicate the answers using graphs.   **(10 Marks)**

Question 7

(a)   Discuss the Clean Development Mechanism focusing on the objectives, rules, eligibility criteria and the benefits.   **(10 Marks)**

(b)   Discuss the challenges in the implementation of Reducing Emissions from Deforestation and Forest Degradation (REDD+) programme in developing countries.   **(10 Marks)**

(c) Like the Clean Development Mechanism (CDM), the Nationally Appropriate Mitigation Action (NAMA) appears not to have the potential to contribute significantly to Sub Saharan Africa's climate change mitigation efforts. Discuss. **(10 Marks)**

Question 8

(a) With the help of examples, explain the differences between Cost-Benefit Analysis and Cost-Effectiveness Analysis. **(4 Marks)**

(b) The Government of Ghana is considering giving out the Atiwa forest, a pristine forest, to a Chinese Company to mine bauxite in the forest. The table below shows the costs and benefits of the project.

Years	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Benefit	146	156	165	175	185	195	204	214	224	233
Cost	107	103	120	124	130	136	142	147	163	179

(i) Using the Cost-Benefit Ratio and the Present Value of Net Benefit, establish if the project is economically beneficial to Ghanaians. Assume an interest rate of 15%.

(10 Marks)

(ii) An environmental NGO, *Forest for the Poor* realised that the project would have three major impacts: reduce carbon sequestration, reduce the limited tourist attraction that the forest offers and probably, the destruction of the sources of many river bodies such as the Birem River. The NGO, with the help of experts, valued the amount of carbon that could be sequestered and the limited tourist attraction that will be lost. Results of the valuation are presented in the table below.

Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Cost	50	53	55	57	58	50	51	53	60	65

Given the above, should the government of Ghana go on with the project? Justify your answer. **(10 Marks)**

(iii) Discuss the issues of uncertainty and irreversibility of the project taking into consideration that it may probably destroy the source of many rivers in Ghana.

(3 Marks)

(c) Briefly explain Environmental Impact Assessment and Multi-Criteria Analysis with the help of examples **(3 Marks)**