AFRICAN ECONOMIC RESEARCH CONSORTIUM

Collaborative Masters Programme in Economics for Anglophone Africa (Except Nigeria)

JOINT FACILITY FOR ELECTIVES (JFE) 2011

JUNE – SEPTEMBER

ENVIRONMENTAL ECONOMICS II

Second Semester: Final Examination

Duration: 3 Hours **Date: Wednesday, September 21, 2011**

INSTRUCTIONS:

1. This examination has **FOUR QUESTIONS**.
2. You are required to attempt **ANY THREE QUESTIONS**.
3. Each question carries **TWENTY (20)** marks.
4. Write legibly and show all workings

Question 1 (20 marks)

The demand and supply for imported poultry product in an African country where there is perfect competition are given by $p_d = -1100x + 200000$ and $p_s = x^2 + 2000x$ respectively, where x is the quantity demanded and p is the price, $x \geq 0$, $p \geq 0$.

(a) Calculate the equilibrium quantity demanded and price. **(3 marks)**

(b) Calculate the consumer and producer surpluses and hence the welfare to the country. **(6 marks)**

(c) Provide a sketch of the consumer and producer surpluses. **(1 mark)**

(d) If the Food and Drugs Board of that country after extensive research realised that the fat content of imported chicken product was too high and therefore detrimental to the health of the population and proposed to the government to introduce a tax that will increase price to 150,000:

(i) Find the revenue that will accrue to government. **(1 mark)**

(ii) Find the new level of welfare and hence the change in welfare as a result of the tax instrument. **(8 marks)**

(iii) Comment on the welfare change. **(1 mark)**

Question 2 (20 marks)

(a) Briefly explain the contingent valuation method and the travel cost method of environmental valuation. **(4 marks)**

(b) A growing concern in a small African community is water borne diseases that have affected many inhabitants. In order to solve this problem some commentators have advocated for the sinking of boreholes that will provide portable water for the community. The Elders of the community in order to engage in such a project wanted to know the economic cost of non-potable water in the community. The Elders therefore commissioned ECOECON Consult, an Environmental Consulting firm to undertake a study on the economic cost of non–potable water to the community. The Firm after careful consultation decided to use the contingent valuation method to estimate the economic cost by asking 640 households in the community about their Willingness –to- Pay (WTP) for portable water. The table below provides information on households' WTP per annum obtained from the survey.

WTP Range (GH¢)	WTP Midpoint (GH¢)	Frequency (%)
97-120	108.5	1.52
55-80	67.5	1.52
25-50	37.5	2.02
16-20	18	14.65
11-15	13	26.77
6-10	8	30.81
0-5	2.5	22.73

(i) If the total number of households in the community is 584,677, estimate the *number of households* who will be willing to pay and the *expected revenue* at different price (WTP midpoints) per annum. **(4 marks)**

(ii) A private firm is interested in undertaking the project by sinking boreholes in the community. What should be the annual tariff (WTP midpoints) for the company to raise the maximum revenue? (*Note: Sinking the borehole will ensure constant supply of water, fixed cost is very high compared to variable cost and therefore the firm maximises revenue).* **(1 mark)**

(iii) What will be the maximum revenue? **(1 mark)**

(iv) Approximately how many percent of households will use the services of the firm? **(1 mark)**

(v) Using Ordinary Least Squares (OLS) estimate the demand for water in the community. **(5 mark)**

(vi) Using your results in *(v)*, provide an estimate of the economic cost of the use of non-potable water to the Elders. **(1 mark)**

(c) State and explain three biases that may be associated with the contingent valuation method. **(3 marks)**

Question 3 (20 marks)

(a) International efforts to reduce ozone depletion have been largely successful. Explain the problem, measures taken by the international community and why the efforts were successful. **(10 Marks)**

(b)

(i) Briefly explain Environmental Impact Assessment (EIA) **(3 Marks)**

(ii) With the help of an appropriate diagramme explain the relationship between EIA and project implementation cycles **(7 Marks)**

Question 4 (20 marks)

(a) Consider the dynamic optimization model below where an economy uses both man-made reproducible and non-renewable inputs in production.

$$Max\ W = \int_{t=0}^{t=\infty} U(C_t)e^{-\rho t}dt$$

$$\dot{S}_t = -R_t, \qquad \dot{K}_t = Q_t(K_t, R_t) - C_t$$

where $Q_t = Q(K_t, R_t)$ is the production function

$U_t = U(C_t)$ linear utility at time t, C_t - consumption at time t

W –inter temporal social welfare function

K_t - man made capital stock at time t, S_t stock of resource at time t, R_t rate of resource extraction at time t.

Assume that capital does not depreciate and is used to produce output that is consumed or added to existing stock and show that:

$$EDP_t = C_t + I_t - Q_{R_t}R_t = NDP_t - Q_{R_t}R_t,$$

where EDP_t is environmentally adjusted national income, I_t is investment in time t, NDP_t is net domestic product. **(10 Marks)**

(b) Discuss the two broad frameworks (guidelines) for correcting national accounts for the omission of environmental factors. **(10 Marks)**