AFRICAN ECONOMIC RESEARCH CONSORTIUM

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

JOINT FACILITY FOR ELECTIVES (JFE)

JUNE – SEPTEMBER 2007

ENVIRONMENTAL ECONOMICS I

First Semester: Final Examination

Duration: 3 Hours **Date: Tuesday, August 7, 2007**

INSTRUCTION:

Answer **ANY FOUR (4)** Questions.

Question 1

(a). Explain the concept captured by the environmental Kuznets curve. **(2 marks)**

(b). Suppose that the Kuznets curve is estimated for your country and that the relationship is found to hold. What major precautions must be taken into account in interpreting the results? **(7 marks)**

(c). What are the basic principles of sustainable development? **(6 marks)**

Question 2

Consider a simple model of bio-economic equilibrium in an open access fishery in which resource growth is logistic is given by:

$$\dot{S} = G(S) = r\left(1 - \frac{S}{S_{\max}}\right)S$$

$H_t = \alpha ES$ and

$\frac{dE}{dt} = 0$

Where H is fish harvests, S is the fish stocks, r is the intrinsic rate of growth of fish S_{max} is the carrying capacity of the ecosystem in which fish is found, and α is the fish catchability coefficient. Each ton of fish is sold at a price P and each unit of effort is purchased at W units of money.

(i) Find the values of the equilibrium fishing effort and fish stocks. **(6 marks)**

(ii) How would the values in (i) change when the cost of effort and the price of fish decrease? **(3 marks)**

(iii) Suppose the growth and harvest functions for the fishery were the same as the above, but instead the fishery is managed by a single profit maximizing unit. Compare the open access and profit maximizing equilibrium stocks. **(6 marks)**

Question 3

(a). Explain the concept of sustainability implied by the Hartwick rule. What problems will an economy encounter in applying the rule? **(5 marks)**

(b). Explain what natural resource accounting aims at. **(5 marks)**

(c). What difficulties may an economy encounter in effecting natural resource accounting? **(5 marks)**

Question 4

Consider an economy that produces a single output Q using one non-renewable resource R, and one reproducible input K. The extraction of the non-renewable resource involves costs that depend on both the extraction rate and the available stock of the resource. The problem facing this economy is to identify an optimal depletion path for the non-renewable resource. The social welfare function is utilitarian.

(a). Derive and explain the static and dynamic efficiency conditions necessary for solving the problem. **(7 marks)**

(b). What happens to consumption along the optimal path? **(6 marks)**

(c). What is the effect of an increase in the discount rate? **(2 marks)**

Question 5

An economy that lives for two periods has a constant supply of a non-renewable resource equal to 150 tonnes. Marginal extraction costs are constant and equal to c. The demand for the resource is constant over the two period, and is given by

$p_t = a - \frac{b}{2} R_t$, and the social discount rate is ρ.

(a). Find and explain the expression that shows how the net prices change over the two periods. **(4 marks)**

(b). Suppose a is 10, b is 1.6, c is 5 and the social discount rate is 5%. Determine the optimal extraction rates in each period. **(6 marks)**

(c). Show that the imposition of a tax on the resource royalty will not change the optimal depletion path. **(5 marks)**

Question 6

(a). Consider this problem of a forest owner. He plants trees in period *0* at a cost equal to *C*, the tree maintenance costs are zero. The trees mature at time T, and the stand is harvested once. Determine the optimal time when the trees should be harvested. **(5 marks)**

(b). How would the imposition of a revenue tax affect the optimal decision? **(5 marks)**

(c). Considering the nature of forests as resources, why would your decision in (a) be inappropriate to society? **(5 marks)**

THE END