AFRICAN ECONOMIC RESEARCH CONSORTIUM

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

JOINT FACILITY FOR ELECTIVES
JUNE – OCTOBER 2005

ENVIRONMENTAL ECONOMICS

First Semester: Final Examination

Time: 09.00 AM – 12.00 Noon **Thursday August 11, 2005**

INSTRUCTIONS: The exam has two parts. Answer any 3 questions from Part I and only 1 question from Part II. Start each question on a new page and write legibly.

PART I:

There are five questions in this part. Provide answers for ANY THREE questions. This part will carry 45 points.

Question 1.

Choose any three concepts from the list below and give a short note (not more than five (5) lines) on each. Each answer carries 5 points. ***(15 marks)***

a) Naturalist moral philosophy

b) Scarcity rent

c) Open access resources

d) Pigouvian tax

Question 2.

Describe sustainability from the economics' point of view ***(4 marks)***. Explain how it relates to the notions of Pareto efficiency and optimality ***(6 marks)***. Can allocations that give disproportionately large amounts of a non-renewable resource to current generations relative to future generations, meet this criterion? Why or why not? Explain clearly. ***(5 marks)***.

where C(.) is convex, that is we assume C'(.) > 0, C''(.) > 0.

(i) Obtain the optimisation problem of the firm (***1 mark***)

(ii) Write the current value Hamiltonian for the problem (***2 marks***)

(iii) Derive the set of maximum principle for the problem (***3 marks***)

(iv) show that the price of the resource net of marginal cost must rise over time at a rate equal to the discount rate. ***(4 marks)***

b) Fishers can often catch more fish by decreasing effort. Explain this ***(5 marks)***.

Part II:

This part has two questions. Answer only 1 question. This part carries 15 points.

Question 6.

Suppose we have a non-renewable resource with a finite stock of 200 units. The marginal cost of extraction constant at 20 units of currency. The discount rate is 10% and we know in period 1 that due to technological change, the demand for the resource will decrease in period 2. Hence, there are different demand functions for each period. In particular, inverse demand functions for the two periods are:

$p_0 = 60 - 0.4q_0$

$p_1 = 80 - 0.4q_1$

a) Obtain the net benefit function for each period ***(2 marks)***

b) Formulate the optimisation problem using the Lagrangean method ***(1 mark)***

c) What is the socially optimal quantity of resource extraction in the two periods? ***(3 marks)***

d) What is the optimal real (current) price of the resource in the two periods? ***(2 marks)***

e) What is the marginal user cost/scarcity rent/shadow price) of the resource in the two periods? ***(2 marks)***

f) Because of growth in population and economic growth per capita, it is likely that demand for exhaustible resources will shift outward in the future. How will this affect the extraction path of the resource? ***(5 marks)***

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Question 7.

Suppose that:

The growth function

$\dot{X} = F(X) = rX(t) - \frac{r}{K}\left[X(t)\right]^2$ describes the behaviour of a given biological population.

Where

$F(X)$ = the logistic equation

r = the intrinsic growth rate

$X(t)$ = the stock of the population at time t

K = the maximum carrying capacity of the environment, and

The yield/production function is given as

$H\left(E(t), X(t)\right) = qE(t)X(t)$

a) Find $X(t)$ ***(5 marks)***

b) Derive the sustained yield function ***(4 marks)*** and the maximum sustainable yield ***(3 marks)***

c) What are the problems of implementing the management principle of 'ensuring the existence of a stock that allows the maximum growth of a renewable population, and harvest the maximum sustainable yield'? ***(3 marks)***