2580007

THE UNIVERSITY of York

Degree Examination 2007

ENVIRONMENT DEPARTMENT

MSc Environmental Economics & Environmental Management
MSc Environmental Economics
MSc Environmental Science & Management
MSc Marine Environmental Management

ENVIRONMENTAL ECONOMICS

Time allowed: **two hours**

Section A is worth 50% of the total marks for the paper.
Marks awarded for each part of each question in Section A are shown.
Answer ALL questions in Section A in the space provided on the examination paper.

Section B is worth 50% of the total marks for the paper.
Marks awarded for each part of each question in Section B are shown.
Answer ANY TWO questions in Section B on the separate paper provided.

Calculators are provided

Pay adequate attention to spelling, punctuation and grammar, so that your answers can be readily understood

Candidate Exam No:

SECTION A

Question 1

A firm emits a pollutant as a consequence of producing its product L. The marginal social benefit gained from the product is given by $MB = 62 - 2L$. The marginal social cost of production is given by $MC = 2 + 4L$. L is measured in tonnes.

a) What is the socially efficient production level?

(2 marks)

A Pigouvian tax is proposed to correct for this pollution externality. The total external cost caused by the pollution externality is $TEC = L^2$.

b) What Pigouvian tax rate should be set to correct for the externality ?

(2 marks)

Question 2

a) In the context of a tradeable emissions permit system (EPS), what does the term *grandfathering* mean ?

(2 marks)

Candidate Exam No:

Question 2 (continued)

b) Why does *grandfathering* often occur ?

(2 marks)

Question 3

State two advantages which an emissions tax policy offers over command and control regulation for managing pollution ?

(2 marks)

Question 4

Which influential ecological economist working in the 1970s promoted '*the steady-state economy (SSE')* as an alternative to the neo-classical growth paradigm which was prevalent within economic thought at that time ?

(1 mark)

Candidate Exam No:

Question 5

a) Which characteristics distinguish *public goods* from *private goods*

(2 marks)

b) Society comprises two households A & B, both of which benefit from the provision of public parkland *G*, an environmental public good. The marginal benefit which household A derives from parkland is $MB_A = 12 - 1.5G$. The marginal benefit which household B derives from parkland is $MB_B = 14 - G$. Parkland is provided by government at a marginal cost of $MC = 0.25G$. *G* is measured in hectares (ha). MB_A , MB_B and *MC* are measured in £ per hectare (£/ha)

(i) Using a sketch graph, show society's demand for public parkland. Take care to specify society's demand curve for parkland clearly on your diagram.

(5 marks)

Candidate Exam No:

Question 5 (continued)

(ii) Calculate how much parkland the government should provide to maximise social net benefits from parkland?

(2 marks)

c) Explain briefly why it is difficult for policy makers to provide an environmental public good in the socially efficient quantity.

(4 marks)

Candidate Exam No:

Question 6

Using a pollution externality caused by a monopolistic producer as an example, describe briefly what is meant by the *second best tax rate* and explain what this second best tax rate aims to ensure ?

(3 marks)

Question 7

Explain briefly what the following terms mean in the context of the Kyoto protocol and flexible mechanisms for realising reductions in greenhouse gas emissions

a) *Annexe 1 countries*

(1 mark)

b) *Joint implementation (JI)*

(2 marks)

Candidate Exam No:

Question 8

Table 8 below shows estimated regression coefficients linking pollutant concentrations (in ppm) at 2 receptor sites to pollutant emissions (in tonnes) from 2 sources. The regression relationships estimated were of the form:

$$P_j = \alpha_j + \sum_{i=1}^{2} \beta_{ji} E_i$$

where: P_j = pollutant concentration at receptor j [ppm]
E_i = pollutant emissions from source i [tonnes]

Table 8: All estimated coefficients are significant at $p<0.05$. Overall relationships are also significant at $p<0.05$.

Pollution concentration at receptor j	Estimated coefficients			Regression R^2
	α_j [ppm]	β_{ji} [ppm per tonne]		
		i=1	i=2	
j=1	40	0.3	0.5	0.76
j=2	35	1.0	0.2	0.82

Emissions from Source 1 with no abatement are 50 tonnes
Pollutant concentration at Receptor 1 with no abatement is 70 ppm

a) Calculate:
(i) Emissions from Source 2 with no abatement

(1 mark)

(ii) Pollutant concentration at Receptor 2 when both sources are emitting at their un-abated levels.

(1 mark)

Candidate Exam No:

Question 8 (continued)

b) An ambient pollution target of 85 ppm is to be introduced at each receptor. At which of the two receptor sites does this ambient pollution target impose a binding constraint on the minimum cost solution to this ambient pollution problem ?

(1 mark)

Question 9

Firm 1 and Firm 2 both emit a uniformly mixing pollutant. The total cost of pollution abatement (cleanup) for each firm is:

for Firm 1: $C_1 = 1.5A_1^2$
for Firm 2: $C_2 = 4.5A_2^2$

where: A_1 = abatement (cleanup) by Firm 1 [measured in tonnes]
A_2 = abatement (cleanup) by Firm 2 [measured in tonnes]
C_1 and C_2 are measured in £

Emissions from each firm with no abatement are:
for Firm 1: 70 tonnes
for Firm 2: 60 tonnes

The pollution target is 90 tonnes.

a) State the problem facing the pollution regulator in the form of a cost minimisation problem with a pollution constraint.

(3 marks)

Candidate Exam No:

Question 9 continued

b) Using either the Least Cost Theorem, or the Lagrangian method, calculate the level of abatement for each firm which will achieve the pollution target at lowest overall cost.

(4 marks)

A tradeable permit scheme will be used to regulate this uniformly mixing pollutant. 90 permits will be issued. Each permit will allow a firm to emit 1 tonne of the pollutant. Assuming the permit market is ideal:

c) How many permits will each firm hold after permit trading is complete ?

(3 marks)

Candidate Exam No:

Question 9 continued

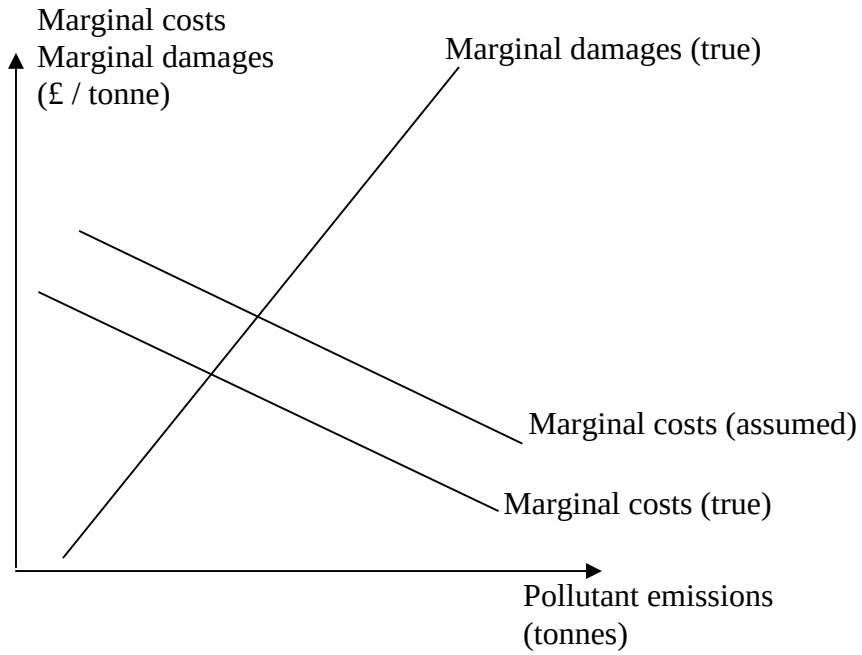
d) What will the final (market clearing) trading price of the permits be ?

(2 marks)

Question 10

For the situation shown in the diagram below, explain whether (a) a tax-based, or (b) a quantity-based (e.g. pollution licences) regulation method would be preferred to minimise the social efficiency loss from incorrect estimation of the marginal cost of pollution abatement. [Illustrate your explanation on the diagram]

(5 marks)



PART B

1.

a) Discuss the main assumptions of classical and environmental input-output analysis.

(4 marks)

b) Consider Table 1. It is an Input-Output Table of an hypothetical economy:

Table 1. Input-Output Table (£ million)

	Intermediate Sectors			***Final Demand***		*Total Output*
	Agriculture	**Manufacturing**	**Services**	Households	Exports	
Agriculture	0	520	0	650	130	1300
Manufacturing	455	0	195	1040	910	2600
Services	130	260	0	390	0	780
Imports	325	780	65			
Wages	260	650	390			
Other Value Added	130	390	130			
Total Inputs	1300	2600	780			

i) Compute the direct requirements matrix and use the second order approximation of the Newman series to approximate the Leontief's inverse (*use k = 2*) **(7 marks)**

ii) Interpret the coefficients of the manufacturing sector of the Leontief's inverse. **(3 marks)**

iii) Table 2 shows the amount of direct SO2 emissions measured in tonnes of SO2 emitted per million of pound of spending on domestic production of the hypothetical economy:

Table 2. Direct CO2 emissions

	Agriculture	*Manufacturing*	**Services**
SO2	1600	400	550

Define and compute the indirect emission vector and interpret its values. **(7 marks)**

iv) Discuss the rationale of *linkage* effects to environmental IO analysis. **(4 marks)**

2. Discuss the UNSTAT proposal of environmental satellite accounting and its practical limitations.

(25 marks)

3. Table 3 reports the results of the EKC panel data regression model. Results include individual and
time specific effects. The depended variable is the log of CO2 emissions measured in tonnes per capita.
The independent variables are the log of GDP per capita measured in 1990 real international dollars, the GDP square and the log of OPEN. OPEN indicates the degree of free trade liberalisation of a country and is obtained as the ratio of imports plus exports to GDP.
The sample is composed of 104 countries. The time period considered is 1990-2000.
P-values for regression coefficients and Hausman test are expressed in parenthesis.

Table 3. EKC Panel Data Model Regression Results

REGION	**WORLD**		**OECD**		**NON-OECD**	
Model	**Fixed Effect Model**	**Random Effect Model**	**Fixed Effect Model**	**Random Effect Model**	**Fixed Effect Model**	**Random Effect Model**
LGDP	2.53 (0.0005)	1.80 (0.0033)	0.88 (0.0000)	0.95 (0.0000)	0.79 (0.0000)	0.85 (0.0000)
LGDPSQ	-0.68 (0.009)	-0.45 (0.0000)	-0.34 (0.0052)	-0.32 (0.00189)	-0.67 (0.0423)	-0.69 (0.0215)
LOPEN	-0.70 (0.0028)	-0.50 (0.0000)	-3.54 (0.0031)	-2.35 (0.0182)	4.20 (0.0000)	2.86 (0.0000)
Constant		-2.92 (0.0225)		-23.7 (0.0005)		-4.15 (0.0044)
Hausman Test	15.33 (0.0000)		5.65 (0.13220)		14.24 (0.00433)	

a) Discuss the economic and statistical significance of LOPEN in the NON-OECD sample estimated with the Fixed Effect Model.

(3 marks)

b) Discuss:

i) The use of OLS *vs* panel data regression models in EKC studies.

(10 marks)

ii) The appropriateness of Random Effect Model and Fixed Effect Model for the OECD sample.

(3 marks)

c) Compute the turning points with respect to log GDP for the WORLD sample and for both Fixed and Random Effect Models.

(3 marks)

d) Discuss the policy implications of the estimated EKC panel regression model.

(6 mark