THE UNIVERSITY OF YORK

Degree Examination 2007

ENVIRONMENT DEPARTMENT

BSc in Environment, Economics and Ecology
Part 1b

ECONOMICS OF ENVIRONMENTAL POLICY

Time allowed: one and a half hours

Answer THREE questions from FIVE

Calculators and graph paper will be provided

Pay adequate attention to spelling, punctuation and grammar, so that your answers can be readily understood
1. Consider Firm 1 and Firm 2 with the following marginal abatement costs:

   Firm 1: \( \text{MAC}_1 = 225 - \frac{1}{2} E_1 \)
   Firm 2: \( \text{MAC}_2 = 130 - \frac{1}{2} E_2 \)

   where \( E \) is the level of pollution emission.

   a) Compute the total quantity of pollution emitted by Firms 1 and 2 if there is no environmental policy intervention. \((10\% \ of \ marks)\)

   b) The Environment Agency decides to reduce total emissions by 40%. Assuming that Total Costs are not known discuss the possibility of achieving the cost-effective allocation of pollution emissions comparing the following scenarios:

      i. An equal reduction in emissions across the two firms. \((10\% \ of \ marks)\)

      ii. A uniform Pigouvian tax per unit of emissions. \((30\% \ of \ marks)\)

      iii. The establishment of a transferable permit system in which permits are auctioned. \((30\% \ of \ marks)\)

   c) Discuss the limitations of implementing a Pigouvian tax to achieve the target. \((20\% \ of \ marks)\)
The following is the demand function for a product generating a negative externality:

\[ P = 30 - \frac{1}{2} Q \]

where \( P \) and \( Q \) are price and quantity of output produced respectively. The firm’s Private total costs (PTC) is \( PTC = 5Q + 0.2Q^2 \) while the Social Total Cost (STC) for the society is \( STC = 10Q + 0.2Q^2 \).

a) The equilibrium output and price that maximises net private benefit. (10% of marks)

b) The equilibrium output and price that maximises net social benefit. (10% of marks)

c) The equilibrium output and price if the producer is a monopolist. (15% of marks)

d) Plot using the graph paper provided PMC, SMC, SMB and PMB on a diagram indicating equilibrium prices and quantities from parts (a) (b) and (c). (20% of marks)

e) Comment on the results and plots produced. (15% of marks)

f) Discuss the implications of the results for policy. (30% of marks)
3. Consider 2 goods (X and Y), 2 consumers (A and B), and 2 factors of production (capital K, and labour L), together with the following Utility functions:

\[ U_A = U_A(X_A, Y_A) \]
\[ U_B = U_B(X_B, Y_B) \]

and Production functions:

\[ X = X(L_X, K_X) \]
\[ Y = Y(L_Y, K_Y) \]

Describe analytically how the utility and production functions would change if the following externalities were taken into account:

a) Consumption affecting consumption. (5% of marks)

b) Production affecting production. (5% of marks)

c) Production affecting consumption. (5% of marks)

In cases (a) and (b):

i. Given a suitable assignment of property rights, discuss how private bargaining can correct externalities and help to achieve efficient outcomes. (20% of marks)

ii. Discuss the limitations of implementing private bargaining to correct externalities. (15% of marks)

In case (c):

i. Discuss alternative ways for government agencies to correct market failures. (20% of marks)

ii. Consider a second-best problem produced by the presence of externalities and a monopolist in the market. Comment on the gains, if any, achieved by implementing a second-best tax on emissions. (30% of marks)
4. Describe in words and diagrammatically the use of emissions taxes and abatement subsidies. Explain, if any, the limitations of these policy instruments. 
*(100% of marks)*

5. The following tables, *Table 1* and *Table 2*, illustrate the pay-off matrices of net profits for countries A and B, with two strategies: to “pollute” or “not to pollute”.

*Table 1*

<table>
<thead>
<tr>
<th>Country B</th>
<th>Pollute</th>
<th>Don’t Pollute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollute</td>
<td>3,1</td>
<td>0,0</td>
</tr>
<tr>
<td>Don’t Pollute</td>
<td>0,0</td>
<td>1,3</td>
</tr>
</tbody>
</table>

*Table 2*

<table>
<thead>
<tr>
<th>Country B</th>
<th>Pollute</th>
<th>Don’t Pollute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollute</td>
<td>1/2,1/2</td>
<td>4,0</td>
</tr>
<tr>
<td>Don’t Pollute</td>
<td>0,4</td>
<td>1,1</td>
</tr>
</tbody>
</table>

a) Find the Nash Equilibria and any dominant strategies in *Table 1* and in *Table 2*. *(50% of marks)*

b) Evaluate the feasibility and the implications for environmental policy of Country A and Country B in *Table 2* agreeing to cut emissions if the pollutant is a global pollutant. *(50% of marks)*