NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH, NATURAL RESOURCES AND APPLIED SCIENCES
DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES SCIENCES

QUALIFICATION : BACHELOR OF SCIENCE IN AGRICULTURE	
QUALIFICATION CODE: 07BAGA	**LEVEL:** 7
COURSE CODE: ENR721S	**COURSE NAME:** ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS
DATE: NOVEMBER 2022	
DURATION: 3 HOURS	**MARKS:** 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER(S)	M LUBINDA
MODERATOR:	S KALUNDU

INSTRUCTIONS
1. Answer ALL the questions. 2. Write clearly and neatly. 3. Number the answers clearly.

PERMISSIBLE MATERIALS

1. Examination question paper
2. Answering book
3. Calculator

THIS QUESTION PAPER CONSISTS OF 4 PAGES (Excluding this front page)

QUESTION ONE	[MARKS]

a. What is the Material Balance Model? Explain its main assumptions. (6)

b. What is pollution? Explain the types, sources, and scope of pollution. (5)

c. Consider the market for bottled water which is defined by the following demand and supply functions:

$$P = 20 - 0.01Q$$

$$P = 5 + 0.0025Q$$

Where P is the price per bottle and Q is the number bottles, in thousand, that are demanded and supplied in the market per month.

i. Estimate the minimum selling price and choke price? What do these prices mean. (4)

ii. Assuming the market for bottled water is efficient, estimate the allocative efficient quantity and price for bottled water. (2)

iii. Suppose the government wants to introduce a policy that limits the number of water bottles sold in the market to 500 thousand per month. This policy is intended to prevent environmental damage caused by the water bottles. Estimate the welfare effects of the policy. (*Hint: estimate the total surplus before and after the introduction of the policy.*) (8)

Total marks	**[25]**

QUESTION TWO	[MARKS]

a. What is an environmental externality? Using appropriate examples, describe a positive and negative environmental externality. (4)

b. Briefly explain the Coase Theorem. (4)

c. Suppose an abattoir is releasing pollution into a nearby aquafer, and the associated health and ecological damages are not considered in the private market for meat. Suppose you are Policy Analyst working for the Ministry of Environment Forest and Tourism, and you have estimated the following marginal benefits and costs for the meat market.

$$MPB = 900 - 0.5Q \qquad MPC = 100 + 0.3Q \qquad MEC = 0.8Q$$

Where Q is the quantity in thousands of carcases produced and P is the price per carcase.

i. Estimate the quantity and price when the market is in competitive equilibrium. (3)

ii. Estimate the quantity and price when the market is in efficient equilibrium. (5)

iii. Suppose a community owned the right to the aquafer, and it is negotiating with the abattoir that is willing to pay the community to produce more output. For the 900th unit of output, determine range within which a payment would be acceptable to both parties. (9)

TOTAL MARKS	[25]

QUESTION THREE [MARKS]

a. Explain the following concepts related to environmental standards:

   i. Ambient standard

   ii. Performance-based standard

   iii. Technology-based standard

(6)

b. Suppose the City of Windhoek is attempting to set a water quality standard, where water quality is measured in percent of heavy metals abated (A), and the marginal social benefit (MSB) and marginal social cost (MSC) of abatement have been estimated as follows: (6)

$$MSB = 40 - 0.1A \qquad MSC = 36 + 0.25A$$

The Department of Environment Affairs sets the standard at 20 percent. Is this standard set efficiently, too stringently, or too leniently? Explain your answer.

c. Suppose there are two power plants that are releasing sulphur dioxide into the air that exceeds the emission standard. To meet the standard, 100 units of sulphur dioxide must be abated in total. The two plants face the following abatement costs:

$$MAC_1 = 600 + 0.1A_1 \qquad MAC_2 = 600 + 0.9A_2$$

Where costs are measured in thousands of Namibian dollars.

   i. Prove that a uniform standard will not meet the cost-effectiveness criterion. Explain your answer. (6)

   ii. Determine how the abatement levels should be reallocated across the two plants to minimize costs. (7)

TOTAL MARKS [25]

QUESTION FOUR [MARKS]

a. Describe the ecological risk assessment process. (6)

b. Suppose the Department of Environmental Affairs (DEA) seeks to introduce a voluntary emissions trading program, which allows polluters to achieve cost-effective solutions when meeting clean air requirements in the Environmental Management Act. Suppose that the DEA's objective for two major polluters is a 40 percent reduction in carbon monoxide emissions. Suppose further that the two firms face the following costs:

$$Firm\ 1: TAC_1 = 2000 + 3A_1^2 \qquad MAC_1 = 6A_1$$

$$Firm\ 2: TAC_2 = 1500 + 6A_2^2 \qquad MAC_2 = 12A_2$$

Where A_1 and A_2 represents the percentage of carbon monoxide abatement achieved by firm 1 and firm 2, respectively, and TAC and MAC are measured in thousands of Namibian dollars.

i. Calculate the TAC and MAC for each firm if a uniform abatement standard were used. (5)

ii. Is there an economic incentive for the firms to participate in the trading program. Explain your answer. (2)

iii. Quantify the cost savings associated with cost-effective abatement allocation that could be achieved through trading. (8)

iv. At what price must each tradable permit be set to achieve the cost-effective solution. (4)

TOTAL MARKS **[25]**

THE END