Chhatrapati Shahu Ji Maharaj University, Kanpur

Answer Script Details
Barcode 11282910

Roll No. 24023000043
Total Mark 47/75.00

Exam MA-III_ODD_EXAM_NOV_2025
Subject A080904T - Enviornmental Economics (Elective)

Question wise Mark Summary

Q.No	Mark	Q.No	Mark	Q.No	Mark	Q.No	Mark
1A	3/5						
1B	3/5						
1C	3/5						
1D	3/5						
1E	3/5						
1F	3/5						
1G	3/5						
1H	3/5						
1I	3/5						
2	0/15						
3	0/15						
4	0/15						
5	11/15						
6	0/15						
7	0/15						
8	0/15						
9	9/15						

Chhatrapati Shahu Ji Maharaj University
Kanpur, Uttar Pradesh

PART-I

Date of Exam: 18/11/25 Shift: 3rd Room No.: 302
Paper Code: A080904T Subject: Economics Year/Sem.: 3rd
Name of Candidate: Shreya Yadav
Roll No.: 2 4 0 2 3 0 0 0 0 4 3

COE Facsimile | Signature of Invigilator | Signature of Candidate

PART-II

MARKS OBTAINED										
Q.	1	2	3	4	5	6	7	8	9	10
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(b)										
(c)										
(d)										
(e)										
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(g)										
(h)										
(i)										
(j)										
Total										
Total Marks in Figures									Max. Marks	
Total Marks in Words										

A080904T
Paper Code

Signature of Evaluator

PART-III

Course: Master of Arts (Economics)
Session: 2025-26 Year/Semester: 3rd
Subject: Environmental Economics

Paper Code: A 0 8 0 9 0 4 T
Exam Date: 1 8 1 1 2 0 2 5
Name of Candidate: SHREYA YADAV
Father's Name: FATEH BAHADUR SINGH YADAV

महाविद्यालय का कोड College Code: E W 0 0 4
परीक्षा केन्द्र का कोड Exam Centre Code: E W 0 0 4

परीक्षा का प्रकार Type of Exam
Regular ● | Ex. Student ○
Private ○ | Back paper Exam ○

ANSWER BOOKLET NO.
11282910

A080904T
Paper Code

PART-IV

नामांकन संख्या Enrollment Number: C S J M A 2 4 0 0 0 0 6 3 5 5 3

परीक्षार्थी अनुक्रमांक संख्या Candidate's Roll Number: 2 4 0 2 3 0 0 0 0 4 3

पेपर कोड Paper Code: A 0 8 0 9 0 4 T

Shreya.
Signature of Candidate

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नोट : 1. परीक्षार्थी को निर्देशित किया जाता है कि आवरण पृष्ठ के पृष्ठ भाग पर अंकित सभी निर्देशों को सावधानी पूर्वक पढ़ें।
2. बॉक्स में भरी जाने वाली प्रविष्टियाँ काली स्याही से शुरू की जायें। 3. शीटों को मोड़ने या गीले बॉलपेन से भरा जायें।

INSTRUCTIONS TO THE CANDIDATE FOR FILLING PART-I

1. Read the instructions carefully given on the answer script and admit card.
2. Write Date of Exam, Shift, Paper Code & Name of Subject Correctly.
3. Write Name & Roll No. Correctly.
4. Write Semester & Branch Correctly.

INSTRUCTIONS TO THE CANDIDATE FOR FILLING PART-III

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2. Carefully study the example before you start marking.
3. As shown in the example below blacken the circles completely.

4. Make no Stray marks on this sheet.
5. **DO NOT WRITE OR MARK ON THE BAR CODE.**

IN ORDER TO AVOID UFM (UNFAIR MEANS) :

1. The Roll No. and Answer Book no. found elsewhere or any other symbol found in the answer book will be treated as unfair means.
2. Any tempering of Bar Code and Booklet no shall be treated as Unfair Means.
3. Do Not bring the materials like slip of paper/mobile/digital diaries/ study material/ revision notes in examination hall. Possession of the mobiles/ digital diaries/ electronic watch and any other electronic gadget except memory less scientific calculator shall be considered as UFM case.
4. Do not keep or paste currency note in answer script it shall be consider as UFM.

अनुचित साधन से बचने हेतु:

1. उत्तर पुस्तिका के निर्दिष्ट स्थान को छोड़कर अनुक्रमांक एवं उत्तरपुस्तिका का क्रमांक कहीं और न लिखे तथा कोई भी चिन्ह न बनायें क्योंकि यह अनुचित साधन प्रयोग की परिधि में आता है।
2. उत्तर पुस्तिका के बारकोड अथवा उत्तर पुस्तिका संख्या पर छेड़ करने पर अनुचित साधन प्रयोग माना जायेगा।
3. परीक्षा कक्ष में निम्न वस्तुएं साथ न लायें, जैसे लिखे हुए कागज के टुकड़े, मोबाईल, डिजिटल डायरी, कोपी, पुस्तक यह सभी वस्तुएं जो अनुचित साधन के अन्तर्गत आती है। केवल सबंधित प्रश्नपत्र में ही मेमोरी लैस साइंटफिक केल्कुलेटर ले जाने की अनुमन्यता होगी।
4. उत्तर पुस्तिकाओं में रूपये न रखें न ही उत्तर पुस्तिका में चिपकायें। ऐसा करना अनुचित साधन प्रयोग की परिधि में आता है।

परीक्षार्थी के लिए निर्देश

1. प्रवेश पत्र एवं उत्तर पुस्तिका पर दिये गये निर्देशों को ध्यान से पढ़ें।
2. कवर पृष्ठ के दूसरी तरफ कुछ न लिखें।
3. उत्तर पुस्तिका के पृष्ठों पर दोनों तरफ लिखें।
4. प्रश्न पत्र पर अपने अनुक्रमांक के अतिरिक्त कुछ न लिखें।
5. प्रश्न पत्र कोड एवं प्रश्न पत्र कोड सावधानी पूर्वक लिखें।
6. अपनी स्थिति स्पष्ट लिखें।
7. उत्तर पुस्तिका के पृष्ठों की संख्या देखें। अगर उत्तर पुस्तिका में पृष्ठ (1–24) से कम है या फटे हुए है, तो परीक्षा शुरू होने के पूर्व दूसरी उत्तर पुस्तिका ले लें।
8. प्रश्नपत्र को देख, यदि प्रश्नपत्र के विषय कोड, विषय का नाम तथा प्रश्न में कोई त्रुटि है तो उसके परीक्षा शुरू होने के 30 मिनट के अन्दर कक्ष निरीक्षक को तत्काल सूचित करें, उसके बाद विश्वविद्यालय द्वारा कोई कार्यवाही नहीं की जायेगी।
9. प्रश्नों के उत्तर लिखने के लिये पेंसिल का प्रयोग न करें।
10. B कोपी या अतिरिक्त ग्राफ नहीं दिया जायेगा।

INSTRUCTIONS TO THE CANDIDATE

1. Read the instructions carefully given on the Question Paper, Admit Card & Answer Script.
2. Do not write anything on back side of the cover page.
3. Write on both sides of pages of answer book.
4. Do not write anything on question paper except Roll Number.
5. Write Paper Code & Question Paper Id carefully.
6. CHECK the number of pages (1-32) or any other kind of damage in your answer script, if found than change the answer script immediately before the commencement of examination.
7. CHECK the Question Paper for any kind of discrepancy e.g. Subject Code, Subject Name and Question of the Question Paper during first THIRTY MINUTES of the commencement of the exam, so that it can be corrected in TIME. After that no. corrections shall be entertained by the university.
8. Do not use pencil for answering the question.
9. Write status correctly e.g. those appearing in carry over papers should fill in status as Carry Over. Those appearing as Ex-Students should fill in status as ex.
10. No supplementary answer book & graph paper will be provided.

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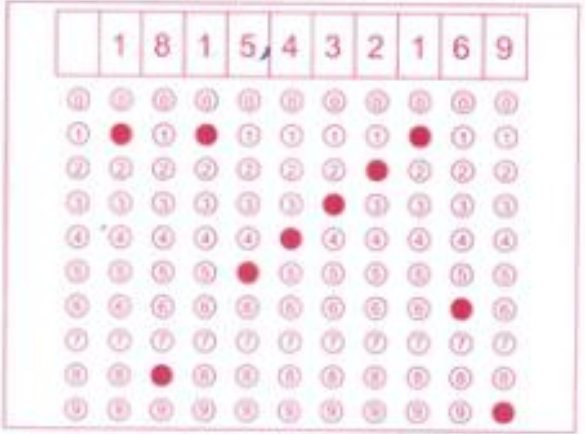
1. Use blue or black ball point pen for writing alphabets & numberals in ☐ Boxes.
2. Use blue or black ball point pen for filling the circles.



Note - If your Roll No. is of 10 digits. Please leave first three columns.

Paper Code

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01

Section - A

Question 1 (A)

Clean Technology

Clean technology often referred to as cleantech or environmental technology encompasses a broad set of processes, products, and innovations that reduce negative environmental externalities while improving resource efficiency. From environmental economics perspective, clean technology represents a class of technologies that internalize environmental costs, mitigate market failures associated with pollution and enable a transition toward low-carbon sustainable production system.

At its core, clean technology involves three essential characteristics :—

1.) Reduced Environmental Impact:

Clean technologies aim to lower emissions of greenhouse gases, reduce air & water pollutions, minimize waste generation and conserve natural resources. For eg, include solar PV, wind power, green hydrogen, electric mobility, advanced waste to energy systems, and carbon capture technologies. Their adoption reduces the social cost of carbon an other pollution related damages.

2.) Improved resource productivity and efficiency.

These technologies enhance the efficiency with which inputs i.e. energy, water materials are transformed into outputs. Energy efficient appliances, LED lighting, industrial process optimization, and circular economy innovations (such as a closed loop recycling and bio-degradable materials) reduce the resource extraction and energy use.

3.) Substitutable toward low Carbon Alternatives

Clean technologies often serve as substitutes for carbon intensive or pollution intensive technologies. For instance, renewable electricity substitutes fossil fuel based generation, EVs substitute internal combustion engines, compostable materials substitute single use plastics. In economic terms, this reflects technological change that shifts the production function toward cleaner outputs.

Types of Clean technologies:-

1.) Renewable Energy technologies
2) Energy efficiency technologies
3) Pollution control and remediation
4) Sustainable transportation
5) Circular Economy and material innovation.

Question 1(B)

Importance of environmental ethics

Environmental ethics refers to the moral principles governing human interaction with the natural environment. It provides a normative foundation for why and how societies should protect ecological systems, conserve resources, and ensure environmental justice. Its importance spans ecological, economic, and social dimensions.

1.) **Provides a moral foundations for environmental protection.**

Environmental ethics establishes that nature has intrinsic value beyond its utility to humans. This normative stance motivates stronger conservation behavior and supports policies that protect biodiversity, ecosystems, and future generations, even when market incentives alone are insufficient.

2) **Corrects market failure and guides policy design.**

Many environmental problems such as pollution, climate change, and over exploitation stem from treating environmental goods as externalities. Ethical considerations reinforce the need for

internalising these externalities via carbon pricing, regulation, and sustainable resource management. Ethics ensures policy decisions reflect fairness, not just efficiency.

3.) ~~Policy~~ Promotes Intergenerational Equity

Climate change, deforestation, and resource depletion impose burdens on future generations who cannot participate in present day decision making. Environmental ethics introduces the principle of inter-generational responsibility, guiding sustainable development and long term investment in clean technologies.

4.) Enhances sustainability decision making

Environmental ethics encourages holistic thinking that includes ecological limits, social well-being, and long term resilience. This supports frameworks like the precautionary principle, circular economy models, and eco system based management.

5.) Strengthens global environmental governance

International agreements are rooted in ethical principles such as shared responsibility, fairness, and protection of common resources. Ethics helps align diverse national interests toward collective action.

Question 1 (c)

Environmental Degradation

Environmental degradation refers to the deterioration of the natural environment caused by human activities and to a lesser extent, natural processes. It involves the depletion of natural resources, the disruption of ecological systems, and the decline in the quality of air, water, soil, and biodiversity. From an environmental economics perspective, degradation arises primarily due to market failure, externalities and unsustainable patterns of production and consumption.

Decline in environmental quality

environmental degradation includes pollution of air (e.g. particulate matter, SO_2, NO_x), water contamination, soil erosion, and the accumulation of hazardous waste. These changes reduce the ecosystem's capacity to support life and impose substantial social costs.

Overexploitation of natural resources

Excessive extraction of renewable and non-renewable resources such as forests, fisheries, groundwater, and minerals leads to resource depletion. Over-

exploitation often occurs because resources are treated as common pool grounds, resulting in the tragedy of the commons.

Loss of biodiversity and habitat destruction

Deforestation, land conversion for agriculture and urbanization, wetland drainage, and climate driven ecosystem shifts result in biodiversity loss. This reduces ecosystem resilience and weakens services such as pollination, carbon sequestration, and water purification.

Climate change as a form of global degradation

The accumulation of greenhouse gases from fossil fuel combustion, industrial processes, and land use change contributes to global warming. This is one of the most severe forms of environmental degradation, affecting sea levels, weather patterns, and global economic stability.

Social and Health implications

Degradation increases disease burdens, reduces agricultural productivity, and threatens livelihoods especially for vulnerable populations. It also creates environmental injustice, where marginalized communities bear disproportionate environmental risks.

Paper Code
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07

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Question 1(D)

Importance of health services in economic development:-

1.) **Enhances labor productivity** → healthier workers produce more output.

2.) **Reduces absenteeism** → fewer sick days increase effective labor supply.

3.) **Improves human capital formation** → health complements education and skills.

4.) **Increases life expectancy** → longer working lives contribute to higher national income.

5.) **Reduces healthcare costs in the long run** → preventive care lowers future public expenditure.

6.) **Attracts investment** → a healthy workforce draws both domestic and foreign investors.

7.) **Supports demographic dividend** → improved health outcomes maximize benefits of a young population.

8.) **Enhances cognitive development** → better childhood health leads to more productive adults.

9.) Breaks poverty cycles → fewer medical shocks prevent households from falling.

10.) Boosts labor force participation → especially among women and older adults.

11.) Improves worker efficiency → reduces physical and mental limitations.

12) Strengthens economic resilience → healthier populations recover faster from crisis & disasters.

13) Promotes social stability → reduces inequality and improves quality of life.

14) Encourages saving and investment → lower disease burden increases disposable income.

15.) Supports technological adoption → healthy workers adapt more easily to new techs.

16) Enhances global competitiveness → nations with strong health systems perform better economically.

17) Reduces burden on social welfare systems → fewer dependents due to illness.

Question 1(E)

Environmental pollution

It refers to the introduction of harmful substances or energy into the natural environment at levels that exceed the ecosystem's capacity to absorb them without adverse effect. It results in the deterioration of environmental quality and poses risks to human health, ecological stability and economic welfare.

Environmental pollution occurs when pollutants i.e. chemical, physical, or biological enter air, water, & soil causing undesirable changes. These pollutants may arise from industrial activities, transportation agriculture, urbanisation or natural disasters but are primarily linked to human actions.

Types of Pollution

1.) Air Pollution → Emissions of particulate matter (PM2.5, PM10), CO_2, SO_2, NO_x from vehicles, industries, and combustion.

2.) Water Pollution → Discharge of sewage, industrial effluents, fertilisers, plastics, and oil spills into rivers, lakes, and oceans.

3.) Soil Pollution → accumulation of pesticides,

heavy metals, and solid waste that degrade soil quality.

4) Noise and light pollution → Excessive noise from traffic or machinery and artificial lighting disrupt natural cycles and human health

5) Thermal and Radioactive Pollution → Heat from industrial operations and radioactive waste from nuclear facilities.

Economic Perspective

Environmental pollution is fundamentally a negative externality, producers and consumers impose environmental costs on society without paying for them. This results in :

1) over production of polluting goods.

2) under provision of environmental quality

3) market failure requiring regulatory intervention (taxes, subsidies, standards, cap and trade etc)

Question 1 (f)

Environment as a Social Entity :-

Environment can be understood as a social entity because it is not only a biophysical system but also a space shaped by human values, institutions, behaviours, and power relations. While ecological processes operate independently of human influence, the way societies perceive, use, manage, and transform the environment is fundamentally social. In environmental economics and social ecology the environment is therefore treated as both natural and socially constructed.

1) Human Environment interdependence.

Societies depend on the environment for resources energy, and ecosystem services. In return, human activities i.e. production, consumption, urbanization modify environmental conditions. This reciprocity make the environment embedded in social systems.

2) Social constructions of Environmental Values

Perceptions of what constitutes "degradation", "conservation", or "sustainability" are influenced by cultural norms, ethics, and collective

preferences. Thus, environmental meaning is socially produced.

3.) Institutional and Policy Dimensions

Environmental quality is shaped by institution such as property rights, regulations, carbon markets, and governance systems. These social mechanisms determine how environmental goods are allocated and protected.

4.) Distributional and Justice considerations

Environmental ha[illegible]ens and benefits are unevenly distributed across communities. This links the environment to social justice, equity and political power making environmental outcomes inherently social.

5.) Collective action and public goods

Environmental resources often display public good characteristics, requiring cooperation, norms, and social coordination to avoid overuse. This reinforces the social nature of environmental management.

Question 1 (G)

Role of Property rights and transaction costs in relation to the Coase Theorem

The coase theorem states that if property rights are well defined and transaction costs are zero or very low, private parties can negotiate efficient solutions to externalities regardless of the initial assignments of rights. The theorem highlights how institutions and costs of bargaining shape environmental outcomes.

1) Importance of well defined property rights

→ Property rights are determining who has the legal authority to control, use, or exclude others from a resource.
→ When rights are clearly assigned – e.g., a farmer's right to clean air or a factory's right to emit parties can bargain to internalize externalities.
→ Clear rights reduce conflict & provide a legal basis for negotiations.

2) Rights allocation and efficiency

→ Coase argued that efficiency is independent of who receives the rights, as long as bargaining is possible.

→ The final outcome will maximize joint welfare.

3.) Role of transaction costs

Transaction cost include :
→ Information costs
→ Bargaining and negotiation costs
→ Enforcement costs
→ Legal administrative costs.
If transaction cost are high, bargaining becomes difficult or impossible, and efficient outcomes may not be reached.

Transaction costs ~~are~~ is environmental problems because →

1) Environmental externalities often involve many affected parties.

2) High transaction costs prevent co-ordination among large groups.

3) Clear property rights alone cannot ensure coasean bargaining in such cases.

4) This explains why markets alone cannot solve large scale pollution problems.

Question 1 (H)

Damage caused by Land Degradation to the environment :-

1.) Loss of Soil fertility

Nutrient depletion and reduced organic matter lower agricultural productivity.

2.) Increased Soil Erosion

Wind and water ~~ex...~~ remove topsoil, leading to sedimentation in rivers and reservoirs.

3.) Decline in biodiversity

Habitat destruction reduces plant and animal species, weakening ecosystem resilience.

4) Desertification and reduced vegetation cover :

Land becomes barren, reducing carbon sequestration and worsening climate impacts.

5.) Water cycle disruption

Reduced infiltration and increased runoff lead to lower groundwater recharge and more frequent floods/droughts.

Question 1(I)

Relationship b/w Population and environment

1.) **Increased resource demand**

Larger populations require more food water, energy, and land, putting pressure on natural resources.

2.) **Land use changes**

Population growth drives urbanization, deforestation, and conversion of natural habitats into agricultural or settlements.

3) **High waste and pollution levels**

More people generate more waste, emissions and environmental pollutants.

4.) **Feedback on human well being**

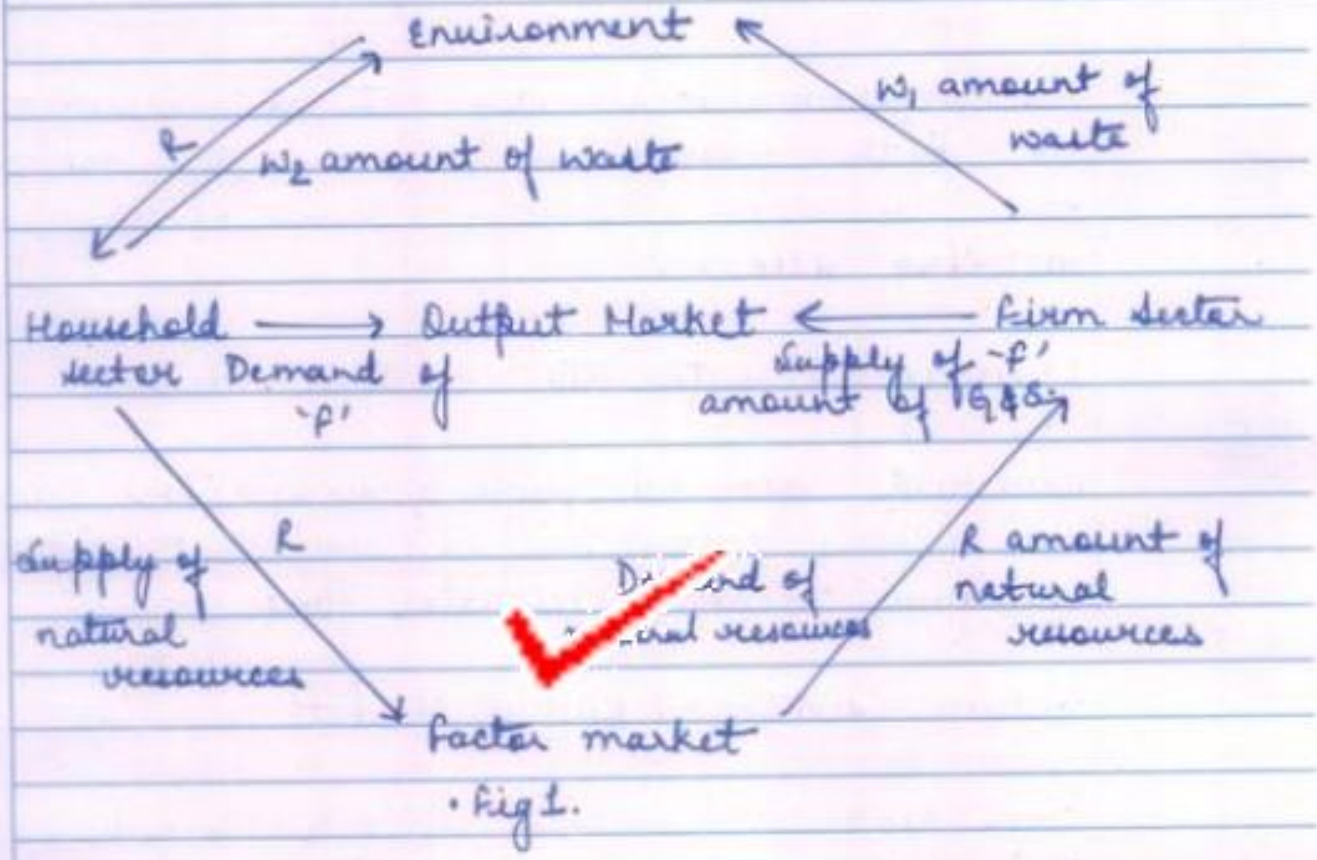
Environmental degradation reduces health livelihoods and overall quality of life.

5) **Environmental Degradation through over-exploitation** → Rising population intensifies extraction of forests, fisheries, minerals, and groundwater leading to degradation.

Section - B

Question 5

Ayres - Kneese material balance model:



• Fig 1.

The Ayres - Kneese Material Balance Model (1969) is a foundational framework in environmental economics. It integrates the laws of thermodynamics, especially the principle of mass conservation into economic analysis. The model emphasizes that all materials extracted from the environment eventually return to it as a waste, highlighting the physical limits of economic activity.

The fig 1, shows the circular flow of the economy integrated with the environment i.e. the core idea of the Ayres-Kneese model.

1) Environment → Household & firm sector (R)

The environment provides natural resource (R) to both households & firms. This represents the resource extraction phase of the material balance.

2) Household sector to → output market

Households demand goods & services (F). They also supply labor. This is consistent with standard economic circular flow.

3) Firm sector → Output Market

Firms produce F amount of g&s & supply them to households. This represents the production phase.

4) Firm sector → factor market

Firms find & demand natural resources & input from the factor market. These include land, labor, capital & raw materials.

5) Factor market → Environment (Resource extraction)

The factor market extracts R amount of natural resources & supplies them to firms

6) Waste flow back to the environment (W_1, W_2)

W_1 → waste generated by firms (industrial waste, emissions, pollution)
W_2 → waste generated by households (municipal waste, sewage etc)

Natural resource (R) → Production → Consumption → Waste (W)

All materials eventually return to the environment degraded.

A-K

Evaluation of the material balance model:

1.) Integrates Environment into Economic Analysis

The model's greatest strength is that it formally links the economy with the environment by showing that all resources inputs eventually become waste outputs

2.) Highlights physical constraints on economic activity.

It incorporates the laws of thermodynamics,

emphasizing that economic systems cannot give ignore material flows and entropy. This makes it more realistic than traditional economic model

3) Clarifies the source of pollution

Pollution is shown not as an abstract externality but as an unavoidable outcome of production and consumption improving understanding of environmental policy needs.

4.) Useful of Policy and Regulation

It provides a strong rationale for waste management, recycling, resource efficiency & pollution control, offering a framework for evaluating environmental taxes & standards.

5.) Limited by its simplified assumptions

While conceptually strong, the model is static & over-simplifies complex ecological interactions. It does not fully capture technological change, renewable resource dynamics or feedback effects.

Section-C

Question 7.

Abatement Model of Leontief:

The Leontief Abatement Model, derived from Wassily Leontief's output-input framework incorporates pollution generation and abatement activities into the production structure of an economy. It recognises that:—

1) Pollution is a joint product of economic activity.

2) Abatement requires resources, making pollution reduction an economic decision involving opportunity costs.

3) The economy must allocate inputs b/w producing goods and reducing pollution.

Leontief's contribution was to embed environmental values directly into the production matrix making clear that pollution cannot be ignored in economic planning. Thus, pollution abatement becomes an explicit 'sector' that absorbs land, capital, and materials.

Core features of the Model:

1.) Joint Production

Production generates desirable outputs (goods) and undesirable by products (pollutants) Pollution cannot be avoided unless additional inputs are directed towards abatement.

2.) Abatement as an Input-using activity

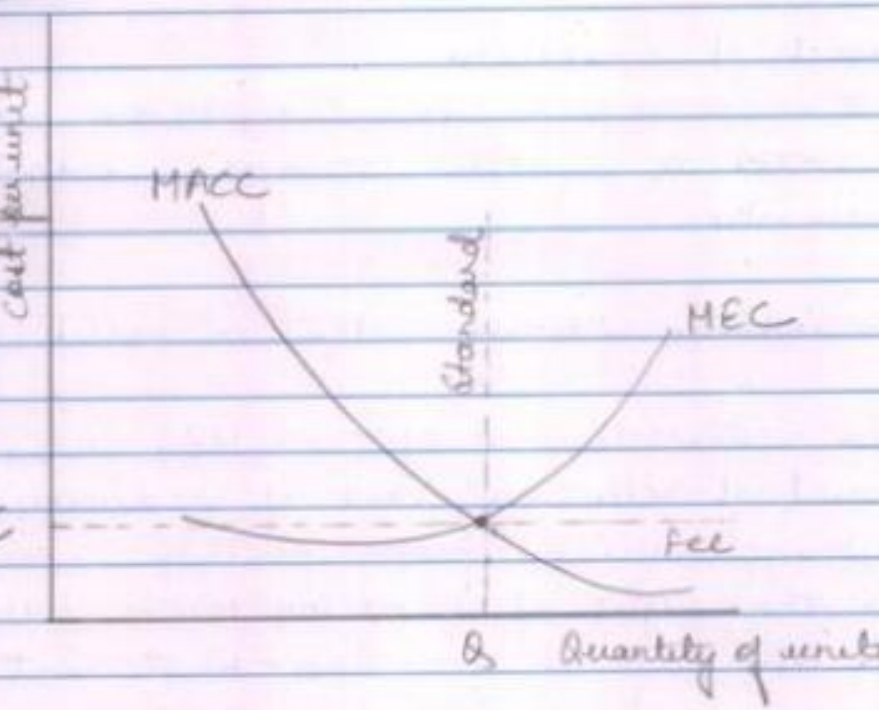
Pollution reduction requires filters, scrubbers, recycling systems, cleaner production practices. These demand economic resources.

3.) Fixed Co-efficients (Leontief Technology)

The model assumes fixed input proportions. Thus, a certain fixed amount of abatement input is required to reduce emissions by one unit.

4.) Trade-off b/w production and abatement.

Allocating resources to environmental protection reduces the availability of resources for regular production. This shows the opportunity cost of environmental improvement.



- MACC (Marginal Abatement Cost Curve) – decreasing curve
- MEC (Marginal [illegible] Cost Curve) – rising

1.) Marginal Abatement Cost Curve: (MACC)

→ Shows the cost of reducing one additional unit of pollution.
→ Decreases with increased pollution.
→ At low pollution (high abatement) MACC is high because it becomes increasingly costly to eliminate the last units of emissions.

2) Marginal External Cost (MEC)

→ Represents the damage caused by an additional

unit of emissions.
→ Increased as pollution rises, since environmental & health damages escalate non-linearly.

3.) Socially optimal pollution level (Q)

The intersection of MACC & MEC gives the efficient level of pollution; Cost of reducing pollution = Damage avoided from pollution reduction.
To the right of Q → Too much pollution
To the left of Q_1 → Over-abatement

4.) Role of policy instrument (Fee/Standard)

The graph shows:

→ Fee (Pigouian tax) = C
A pollution tax equal to the marginal external damage at the optimal level leads firms to internalise costs.

→ Standard (vertical dashed line)
Regulators may set a fixed pollution limit equal to Q.

Both approaches aim to achieve the same efficient levels of emissions.