GUJARAT TECHNOLOGICAL UNIVERSITY

[BE-7 SEMESTER] – OLD PAPER – S22 TO S26 – QUESTION BANK

Subject Name & Code: Cleaner Production & Waste Utilization- 3171304

Chapter A1: Cleaner Production Concept: Theory and Effect on Industrial Economy

Repeated Questions:

1. Definition, Concept and Need of Cleaner Production:

- **Q.** Define Cleaner Production. **(SUMMER 2022, 3 Marks; WINTER 2022, 3 Marks OR; SUMMER 2023, 3 Marks; WINTER 2023, 3 Marks; SUMMER 2025, 3 Marks)**
- **Q.** Discuss the concept of CP. **(SUMMER 2022, 7 Marks; WINTER 2022, 7 Marks; SUMMER 2023, 7 Marks - second set)**

2. Objectives, Benefits and Economic Effects of CP:

- **Q.** Explain effect of CP on industrial economy. **(SUMMER 2022, 4 Marks; WINTER 2022, 4 Marks; SUMMER 2023, 7 Marks - first set; WINTER 2024, 7 Marks - Discuss impact of CP on country's economy)**
- **Q.** Enlist and explain objectives and benefits of CP. **(WINTER 2022, 4 Marks; SUMMER 2023, 4 Marks; WINTER 2024, 7 Marks - Cleaner production)**

3. CP vs End-of-Pipe Approach and EMS:

- **Q.** Differentiate between CP and End-of-Pipe approach. **(WINTER 2022, 7 Marks OR; SUMMER 2023, 4 Marks - second set; WINTER 2024, 4 Marks; SUMMER 2025, 4 Marks)**

4. Waste Hierarchy, 4R's and Related Concepts:

- **Q.** Discuss the concept of 4R's. **(WINTER 2024, 4 Marks; SUMMER 2025, 4 Marks)**
- **Q.** Discuss the hierarchy of cleaner production. **(WINTER 2024, 4 Marks - Explain waste hierarchy; WINTER 2025, 4 Marks; SUMMER 2026, 3 Marks - Represent the hierarchy of cleaner production)**

Other Important Questions:

1. Definition, Concept and Need of Cleaner Production:

- **Q.** Explain need for Cleaner Production. **(WINTER 2023, 4 Marks)**
- **Q.** Define Cleaner Production and explain its importance in reducing industrial pollution. **(SUMMER 2026, 7 Marks)**

2. Objectives, Benefits and Economic Effects of CP:

- **Q.** Write down various benefits of Cleaner Production in industry. **(WINTER 2023, 3 Marks)**
- **Q.** State economic benefits of adopting Cleaner Production. **(SUMMER 2026, 4 Marks)**

3. CP vs End-of-Pipe Approach and EMS:

- **Q.** Differentiate between CP and EMS. **(WINTER 2024, 4 Marks)**
- **Q.** What is Environmental Management System? **(SUMMER 2025, 3 Marks)**

4. Waste Hierarchy, 4R's and Related Concepts:

- **Q.** What do you mean by Waste minimization? **(WINTER 2024, 3 Marks)**
- **Q.** Explain the concept of Pollution prevention. **(WINTER 2024, 7 Marks OR)**
- **Q.** Enlist approaches of industry toward pollution. **(WINTER 2024, 3 Marks OR)**
- **Q.** Explain the CP concept of "Creation of Useful Byproduct". **(WINTER 2025, 3 Marks OR)**
- **Q.** Explain the concept of "zero waste". **(WINTER 2025, 3 Marks OR)**

Chapter A2: Cleaner Production Methodology, Financial Analysis and Mass/Energy Balance

Repeated Questions:

1. CP Methodology, Team and Process Analysis:

- **Q.** Explain six step methodology of CP. **(SUMMER 2022, 7 Marks; WINTER 2022, 7 Marks; WINTER 2024, 7 Marks; SUMMER 2025, 7 Marks)**
- **Q.** How CP team is designated? **(SUMMER 2022, 4 Marks; WINTER 2022, 4 Marks; WINTER 2024, 4 Marks - Enlist criteria for CP team selection OR; SUMMER 2025, 3 Marks - for Dairy industry)**

2. CP Tools and Good Housekeeping:

- **Q.** Enlist and explain CP tools. **(WINTER 2022, 7 Marks; SUMMER 2023, 7 Marks; WINTER 2024, 4 Marks OR; SUMMER 2025, 4 Marks)**
- **Q.** What is Good housekeeping? **(WINTER 2022, 3 Marks; SUMMER 2023, 3 Marks - second set; WINTER 2023, 7 Marks - checklist for Good Housekeeping; SUMMER 2025, 3 Marks)**

3. Selection of CP Solutions, Feasibility and Barriers:

- **Q.** Discuss factors affecting selection of CP solution. **(SUMMER 2022, 4 Marks OR; WINTER 2022, 4 Marks OR; SUMMER 2023, 4 Marks - first set; WINTER 2023, 3 Marks OR; SUMMER 2025, 4 Marks)**
- **Q.** Discuss with respect to CP: (i) Technical feasibility (ii) Evaluation of Environmental Aspects (iii) Economic Viability. **(WINTER 2025, 7 Marks OR; SUMMER 2026, 7 Marks OR)**
- **Q.** What do you mean by sustaining CP? **(SUMMER 2022, 3 Marks OR; WINTER 2022, 3 Marks; SUMMER 2023, 3 Marks - first set; WINTER 2025, 3 Marks - concept of sustainable CP)**
- **Q.** What are the barriers to the CP? **(WINTER 2022, 4 Marks; SUMMER 2023, 4 Marks; WINTER 2023, 7 Marks - barriers for implementation OR; WINTER 2025, 4 Marks - hurdles)**

4. Financial Analysis of CP:

- **Q.** Discuss financial analysis of CP with suitable example. **(SUMMER 2022, 7 Marks OR; WINTER 2022, 7 Marks OR; SUMMER 2023, 7 Marks; WINTER 2023, 4 Marks - coverage of Financial Analysis OR; WINTER 2024, 4 Marks - techniques; SUMMER 2026, 4 Marks - Analyze how financial analysis supports decision-making)**

5. Mass, Energy and Water Balance:

- **Q.** Explain Mass and Energy balance. **(SUMMER 2022, 4 Marks - importance OR; WINTER 2022, 3 Marks OR; SUMMER 2023, 4 Marks; WINTER 2024, 4 Marks - importance of energy balance OR; SUMMER 2025, 4 Marks - importance for CP; WINTER 2025, 4 Marks - importance of material and energy balance OR)**

Other Important Questions:

1. CP Methodology, Team and Process Analysis:

- **Q.** Evaluate the 16 tasks which have to be performed in CP methodology implemented in the Chemical Industry. **(WINTER 2023, 7 Marks)**
- **Q.** How to Analyse process steps? **(SUMMER 2022, 4 Marks)**
- **Q.** What do you mean by Process flow diagram? **(WINTER 2024, 3 Marks)**
- **Q.** According to you, which step is most important in the CP methodology? Justify your answer. **(WINTER 2023, 4 Marks)**
- **Q.** Explain how CP is a continuous process and not a one-time activity. **(WINTER 2025, 3 Marks)**
- **Q.** Explain step by step methodology to implement cleaner production practice in chemical industry. **(WINTER 2025, 7 Marks)**

2. CP Tools and Good Housekeeping:

- **Q.** Give classification of Cleaner Production Tools. **(WINTER 2023, 3 Marks OR)**
- **Q.** How CP tools are effective in pollution reduction? **(WINTER 2025, 7 Marks)**
- **Q.** Enlist and explain parallel approaches to Cleaner production. **(SUMMER 2025, 7 Marks OR)**

3. Financial Analysis of CP:

- **Q.** Propose a Cleaner Production plan for a chemical industry highlighting financial feasibility. **(SUMMER 2026, 7 Marks OR)**
- **Q.** What do you mean by Pay back period? **(WINTER 2024, 3 Marks OR)**

4. Mass, Energy and Water Balance:

- **Q.** What do you mean by Mass balance? **(WINTER 2024, 3 Marks)**
- **Q.** Describe procedure to carry out Material balance. **(WINTER 2022, 4 Marks OR)**
- **Q.** Why material balance is required for Cleaner Production? **(WINTER 2023, 4 Marks OR)**
- **Q.** What do you mean by Water balance diagram? **(WINTER 2024, 3 Marks)**

Chapter A3: Applications of Cleaner Production in Industries and Case Studies

Repeated Questions:

1. Case Studies of CP Implementation:

- **Q.** Discuss one case study of CP implementation. **(WINTER 2022, 7 Marks; SUMMER 2023, 7 Marks - second set; WINTER 2024, 7 Marks - in any one industry)**
- **Q.** Discuss one case study of CP implementation in dairy industry. **(SUMMER 2022, 7 Marks; SUMMER 2025, 7 Marks)**
- **Q.** Discuss one case study of CP implementation in Pulp and paper industry. **(SUMMER 2022, 7 Marks OR; SUMMER 2025, 7 Marks OR)**

Other Important Questions:

1. Case Studies of CP Implementation:

- **Q.** Evaluate a case study where Cleaner Production improved both environmental and economic performance. **(SUMMER 2026, 7 Marks)**

2. CP Opportunities in Industries and Policy Support:

- **Q.** Explain with example how CP is useful in Fertilizer industry. **(WINTER 2025, 7 Marks OR)**
- **Q.** State any four CP opportunities can be implemented by paper industry. **(WINTER 2025, 4 Marks)**
- **Q.** What role a Cleaner production center can play at regional level? **(WINTER 2022, 4 Marks)**
- **Q.** How can government policies support cleaner production? **(WINTER 2025, 3 Marks)**
- **Q.** Write brief note on “Difficulty in assessing the Cleaner Technology”. **(WINTER 2025, 4 Marks)**
- **Q.** Apply the six-step methodology of Cleaner Production to a textile industry example. **(SUMMER 2026, 7 Marks)**

Chapter A4: Energy Audit Methodology

Repeated Questions:

1. Energy Audit – Definition, Objectives and Instruments:

- **Q.** What is Energy audit? **(SUMMER 2022, 3 Marks - Define the term 'Audit'; WINTER 2022, 3 Marks; SUMMER 2023, 3 Marks - second set)**
- **Q.** Explain objectives of Energy audit. **(WINTER 2023, 3 Marks; SUMMER 2026, 3 Marks - List the objectives)**
- **Q.** Enlist instruments used for Energy audit. **(SUMMER 2023, 4 Marks - second set; WINTER 2023, 4 Marks; WINTER 2024, 3 Marks)**

2. Energy Audit – Procedure and Types:

- **Q.** Discuss procedure for Energy audit. **(SUMMER 2022, 7 Marks; WINTER 2022, 7 Marks OR; SUMMER 2023, 7 Marks; WINTER 2024, 7 Marks - key steps OR; SUMMER 2025, 7 Marks - key steps)**
- **Q.** Explain the steps for Preliminary Energy Audit. **(WINTER 2023, 7 Marks; WINTER 2024, 7 Marks OR; SUMMER 2025, 7 Marks - How to carry out Preliminary or Walk-through)**
- **Q.** What is the difference between walk-through Energy audit and detailed Energy audit? **(SUMMER 2023, 4 Marks - first set; SUMMER 2026, 4 Marks - Analyze the differences ... with examples)**

Other Important Questions:

1. Energy Audit – Procedure and Types:

- **Q.** Define preliminary (walk-through) energy audit. **(SUMMER 2026, 3 Marks OR)**
- **Q.** What do you mean by detailed Energy audit? **(SUMMER 2022, 3 Marks OR)**
- **Q.** Describe Walk-through Energy audit. **(SUMMER 2022, 7 Marks OR)**

2. Energy Audit – Applications and Strategy:

- **Q.** Design an energy audit strategy for a medium-scale food processing unit. **(SUMMER 2026, 7 Marks)**
- **Q.** How to identify energy loss in a boiler system through energy audit methodology. **(SUMMER 2026, 4 Marks OR)**
- **Q.** Discuss the outcomes of an energy audit conducted in a cement industry. **(SUMMER 2026, 7 Marks OR)**
- **Q.** Differentiate between Energy audit and financial audit with respect to CP. **(WINTER 2025, 7 Marks)**

Chapter B1: Recycling and Reuse: Concept and Application

Repeated Questions:

1. Recycling and Reuse – Definitions and Concepts:

- **Q.** What is recycling? **(SUMMER 2022, 3 Marks - Define the term 'Recycling'; SUMMER 2023, 3 Marks - first set)**

Other Important Questions:

1. Recycling and Reuse – Definitions and Concepts:

- **Q.** Define Reuse. **(WINTER 2022, 3 Marks OR)**
- **Q.** Define Recycle. **(WINTER 2022, 3 Marks OR)**
- **Q.** What is Recycling and Reuse? **(WINTER 2023, 3 Marks)**
- **Q.** Define Reuse and Recycle. **(SUMMER 2025, 3 Marks)**
- **Q.** Define recycling and reuse with one example each. **(SUMMER 2026, 3 Marks)**
- **Q.** What do you mean by Waste utilization? **(SUMMER 2025, 3 Marks)**

2. Types of Recycling and Integrated Systems:

- **Q.** What do you mean by "Onsite Recycle & Recover"? **(WINTER 2025, 3 Marks OR)**
- **Q.** Name three kinds of recycling, give typical examples. **(WINTER 2025, 3 Marks)**
- **Q.** Suggest an integrated recycling and reuse system for a sugar industry. **(SUMMER 2026, 7 Marks)**
- **Q.** Suggest an integrated recycling and reuse system for a dairy processing plant. **(SUMMER 2026, 7 Marks OR)**

Chapter B2: Recycling and Reuse of Liquid Industrial Waste

Repeated Questions:

1. Recycling and Reuse of Liquid Industrial Waste:

- **Q.** Write a short note on recycling and reuse of Liquid industrial waste. **(SUMMER 2022, 4 Marks - with one suitable example; SUMMER 2025, 4 Marks)**

Other Important Questions:

1. Recycling and Reuse of Liquid Industrial Waste:

- **Q.** List two methods of recycling liquid industrial waste. **(SUMMER 2026, 4 Marks)**
- **Q.** Explain one case study related to the recycling option for liquid waste. **(WINTER 2023, 7 Marks)**
- **Q.** Describe techniques for recycling and reuse of liquid Industrial waste. **(WINTER 2022, 4 Marks OR)**

Chapter B3: Recycling and Reuse of Solid Industrial Waste

Repeated Questions:

1. Recycling and Reuse of Solid Industrial Waste:

- **Q.** Describe Recycling and reuse of Solid industrial waste with one suitable example. **(SUMMER 2022, 4 Marks OR; WINTER 2023, 4 Marks - case study related the recycling option for solid waste)**

Other Important Questions:

1. Recycling and Reuse of Solid Industrial Waste:

- **Q.** What do you mean by Solid industrial waste? **(SUMMER 2022, 3 Marks)**
- **Q.** Analyze the environmental benefits of recycling solid industrial waste. **(SUMMER 2026, 7 Marks OR)**

Chapter B4: Waste Heat Recovery, Flue Gases and Waste Heat Recovery Boilers

Repeated Questions:

1. Waste Heat – Definition, Sources and Heat Loss:

- **Q.** What is Heat recovery? Write down the application of the heat recovery. **(WINTER 2023, 3 Marks; SUMMER 2025, 3 Marks - What do you mean by Heat recovery?)**

2. Waste Heat Recovery Systems, Methods and Types:

- **Q.** Explain with neat sketch Waste heat recovery system. **(WINTER 2022, 7 Marks OR; SUMMER 2023, 7 Marks OR)**
- **Q.** Write down various types of heat recovery System. **(WINTER 2023, 4 Marks OR; WINTER 2025, 4 Marks - types of heat recovery equipment's OR)**
- **Q.** Explain in detail various methods for waste heat recovery. **(SUMMER 2022, 7 Marks - Identify the pathways OR; SUMMER 2025, 7 Marks; SUMMER 2026, 7 Marks - pathways in the cement industry)**

3. Heat Recovery Boilers:

- **Q.** Explain Heat Recovery Boiler. **(WINTER 2023, 7 Marks; WINTER 2025, 7 Marks - with two stacks and with fan; SUMMER 2026, 4 Marks - role of waste heat recovery boilers in energy conservation)**

4. Benefits and Utilization of Heat Recovery:

- **Q.** Write short note on benefits of heat recovery in Steam boiler. **(SUMMER 2025, 4 Marks; WINTER 2025, 7 Marks - Define waste heat recovery. give benefits ... OR)**

Other Important Questions:

1. Waste Heat – Definition, Sources and Heat Loss:

- **Q.** What do you mean by Waste heat? **(SUMMER 2023, 3 Marks - first set)**
- **Q.** What is Heat loss? How can you quantify the heat loss? **(WINTER 2023, 3 Marks OR)**
- **Q.** Discuss sources of waste heat generated in different types of industries. **(WINTER 2025, 3 Marks)**
- **Q.** Define Waste Heat Recovery and state its significance. **(SUMMER 2026, 3 Marks OR)**

2. Waste Heat Recovery Systems, Methods and Types:

- **Q.** Write a short note on heat wheel. **(WINTER 2025, 4 Marks)**
- **Q.** Propose a waste heat recovery system for a thermal power plant with justification. **(SUMMER 2026, 7 Marks OR)**

3. Benefits and Utilization of Heat Recovery:

- **Q.** How waste heat utilization is useful for the industry? **(WINTER 2025, 4 Marks OR)**
- **Q.** "Waste Heat Recovery is useful for prevention and control of pollution." Justify with example. **(WINTER 2025, 7 Marks)**

Chapter B5: Types of Heat Exchangers and LMTD

Repeated Questions:

1. LMTD:

- **Q.** Define LMTD. **(SUMMER 2022, 3 Marks; WINTER 2022, 3 Marks; SUMMER 2023, 3 Marks; WINTER 2024, 3 Marks OR; SUMMER 2025, 3 Marks; WINTER 2025, 7 Marks - What do you mean by the term LMTD? Draw the temperature profiles ...; SUMMER 2026, 4 Marks - Discuss the concept of LMTD OR)**

2. Heat Exchangers – Types and Applications:

- **Q.** What is Heat exchanger? **(SUMMER 2022, 3 Marks OR; SUMMER 2023, 3 Marks - second set)**
- **Q.** Enlist various Heat exchangers with their suitable application. **(SUMMER 2022, 4 Marks - types ... suitability; WINTER 2022, 7 Marks - Enlist and explain various Heat exchangers; SUMMER 2023, 4 Marks - second set; WINTER 2023, 4 Marks - various types; WINTER 2024, 7 Marks OR; SUMMER 2025, 7 Marks - types ... with its application)**

3. Shell & Tube and Plate Heat Exchangers:

- **Q.** Discuss Shell & Tube heat exchanger with neat sketch. **(SUMMER 2022, 7 Marks; SUMMER 2023, 7 Marks - first set; WINTER 2023, 7 Marks - Explain Shell and Tube Heat Exchanger OR; WINTER 2024, 7 Marks; SUMMER 2025, 7 Marks)**

Other Important Questions:

1. LMTD:

- **Q.** Derive equation of LMTD for various flow arrangements. **(WINTER 2023, 7 Marks OR)**
- **Q.** Draw the temperature profiles for counter current flow and parallel flow. **(SUMMER 2025, 4 Marks)**

2. Shell & Tube and Plate Heat Exchangers:

- **Q.** Explain with neat sketch Plate and Frame type heat exchanger. **(SUMMER 2023, 7 Marks - second set)**

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