GUJARAT TECHNOLOGICAL UNIVERSITY

BE SEMESTER 5 – OLD PAPER – S22 TO S26 – QUESTION BANK

Subject Name & Code: Energy Technology - 3150507

Chapter 1 – An Introduction to Energy Sources

Repeated Questions:

1. Energy Resources and World Energy Future (Theory):

- **Q.** Give your thoughts about energy consumption and world energy future / Discuss world energy futures / Write a short note on world energy future / Explain the energy future of the world. **(SUMMER 2022, 3 Marks; WINTER 2022, 3 Marks; SUMMER 2023, 3 Marks; WINTER 2025, 4 Marks)**
- **Q.** Differentiate: Conventional and Non-conventional energy, primary and secondary energy resources / List out conventional and non-conventional energy resources / Differentiate between primary and secondary energy resources. **(SUMMER 2022, 3 Marks; SUMMER 2023, 4 Marks; WINTER 2024, 4 Marks)**

2. Energy Security, Conservation and Audit (Theory):

- **Q.** Define energy security. Why is it important for a growing economy? / Explain the term: energy security. / Define terms: Energy security and Energy audit. **(SUMMER 2023, 3 Marks; WINTER 2024, 3 Marks; WINTER 2025, 3 Marks)**
- **Q.** Define energy audit and write its importance / What is the importance of energy conservation and energy audit? / Elaborate on the terms energy management & energy audit / Define energy audit and explain its importance in industries. **(SUMMER 2022, 3 Marks; WINTER 2022, 4 Marks; SUMMER 2023, 3 Marks; SUMMER 2024, 4 Marks; WINTER 2024, 4 Marks)**
- **Q.** Describe about energy conservation along with its importance / Describe the importance of energy conservation / Explain the importance of energy conservation in the context of a growing economy / Explain the need for energy conservation. **(SUMMER 2022, 3 Marks; SUMMER 2023, 4 Marks; SUMMER 2024, 3 Marks; WINTER 2025, 4 Marks; SUMMER 2026, 3 Marks)**

3. Energy and Environment, Sector Reforms and Energy Management (Theory):

- **Q.** Explain the correlation between energy and environment in detail / Discuss the impact of energy consumption on the environment and how energy conservation helps mitigate these impacts. **(WINTER 2022, 7 Marks; WINTER 2024, 7 Marks)**
- **Q.** Evaluate the impact of energy sector reforms on national energy security and propose further improvements / Why do energy sectors need reforms? **(WINTER 2025, 4 Marks; SUMMER 2026, 7 Marks)**
- **Q.** Explain energy management with different steps / Develop a comprehensive energy management strategy for a university campus, incorporating solar, biomass, and energy efficiency measures. **(SUMMER 2022, 3 Marks; SUMMER 2026, 7 Marks)**

Other Important Questions:

1. Renewable and Non-renewable Energy (Theory):

- **Q.** Elaborate on the terms Renewable and Non-renewable Energy. **(SUMMER 2025, 4 Marks)**
- **Q.** Describe the use of non-conventional energy resources in the chemical industries. **(SUMMER 2025, 3 Marks)**

Chapter 2 – Energy Efficiency in Thermal Utilities

Repeated Questions:

1. Fuels and Combustion:

- **Q.** Define terms: Proximate analysis, ultimate analysis and calorific value / Differentiate between proximate and ultimate analysis / Explain the proximate and ultimate analysis of coal in detail / Explain the proximate analysis of coal and its importance in fuel selection. **(WINTER 2022, 4 Marks; SUMMER 2023, 3 Marks; WINTER 2024, 4 Marks; SUMMER 2025, 7 Marks)**
- **Q.** Why coal preparation is required? Also, explain in detail the steps which are involved to prepare the coal / Discuss in detail the handling and preparation of fuels. **(SUMMER 2022, 7 Marks; WINTER 2025, 7 Marks)**
- **Q.** Discuss in detail the gasification of coal / Explain the process of gasification of coal with a neat sketch. Discuss its advantages in energy conversion. **(SUMMER 2022, 7 Marks; WINTER 2024, 7 Marks)**
- **Q.** What is the significance of calorific value in fuel? / Discuss the role of calorific values in evaluating fuel efficiency for thermal utilities. **(WINTER 2024, 3 Marks; SUMMER 2026, 4 Marks)**
- **Q.** Explain the principle of combustion and describe the factors that affect the combustion efficiency / Describe the principle of combustion and its relevance to energy efficiency in thermal utilities. **(WINTER 2024, 7 Marks; SUMMER 2026, 3 Marks)**

2. Steam Systems:

- **Q.** Name two functions of a steam trap / What is the role of a steam trap in a steam system? **(WINTER 2022, 3 Marks; WINTER 2024, 3 Marks)**
- **Q.** Discuss the steps involved in identifying energy-saving opportunities in steam distribution systems / Develop a comprehensive plan for improving energy efficiency in an industrial steam system, including steam trapping and condensate recovery. **(WINTER 2024, 7 Marks; SUMMER 2026, 7 Marks)**

3. Waste Heat Recovery:

- **Q.** Classify commercial waste heat recovery devices (WHRD) and Explain any one commercial waste heat recovery device / Discuss about commercially viable waste heat recovery devices / Enlist all commercially viable waste heat recovery devices and discuss anyone in detail / Discuss the classification of waste heat recovery devices and their commercial applications. **(SUMMER 2022, 7 Marks; SUMMER 2023, 4 Marks; SUMMER 2024, 7 Marks; WINTER 2024, 4 Marks; SUMMER 2025, 7 Marks)**
- **Q.** What is waste heat recovery? List advantages and applications of waste heat recovery / Explain the principles of waste heat recovery in industrial systems. Discuss various commercially viable waste heat recovery devices and their saving potential. **(WINTER 2025, 7 Marks; SUMMER 2026, 7 Marks)**

4. Insulation and Refractories:

- **Q.** Discuss about Insulation types and its application / Explain the concept of economic thickness of insulation and its relevance in energy conservation / What are the advantages of using insulation in thermal utilities, and how does it contribute to energy savings? **(SUMMER 2023, 4 Marks; WINTER 2024, 4 Marks; SUMMER 2026, 3 Marks)**
- **Q.** Discuss the types, selection and application of Refractories / List refractory applications and explain their role in the selection for Energy saving / Explain the selection criteria of refractories along with their applications. **(SUMMER 2022, 7 Marks; SUMMER 2024, 7 Marks; WINTER 2025, 7 Marks)**

Other Important Questions:

1. Steam Systems:

- **Q.** Name two reasons why steam is used as a heat transfer medium. **(WINTER 2022, 3 Marks)**
- **Q.** Give an example of Energy savings by reducing the work done by steam. **(WINTER 2022, 4 Marks)**
- **Q.** Explain why low-pressure steam is more efficient? **(WINTER 2022, 3 Marks)**
- **Q.** What are the precautions to be taken while steam pressure is reduced for a process? **(WINTER 2022, 4 Marks)**
- **Q.** List different types of steam used in processes. **(SUMMER 2024, 3 Marks)**
- **Q.** Explain the flash steam recovery system. And also list other energy-saving potential for steam systems. **(WINTER 2025, 7 Marks)**

2. Fuels and Combustion:

- **Q.** Differentiate Gross calorific value and Net calorific value. **(SUMMER 2024, 4 Marks)**
- **Q.** List major constituents of LPG and Natural gas. **(SUMMER 2025, 3 Marks)**
- **Q.** Explain the 3 T's of combustion. **(SUMMER 2025, 4 Marks)**
- **Q.** List two properties of fuel oil important for combustion. **(WINTER 2024, 3 Marks)**

3. Comparison and Analysis of Energy Saving Options:

- **Q.** Compare and contrast the energy saving potential of steam system optimizations versus waste heat recovery. **(SUMMER 2026, 4 Marks)**
- **Q.** Analyze the potential for energy savings in an industrial fuel combustion system by integrating advanced insulation materials. **(SUMMER 2026, 7 Marks)**

Chapter 3 – Solar Energy

Repeated Questions:

1. Solar Collectors:

- **Q.** Describe flat plate solar collector with neat sketch / Classify different types of solar collectors and explain any one in detail / Define solar collector. List various types of line-focusing type concentrators and explain one of them. **(SUMMER 2022, 7 Marks; SUMMER 2023, 7 Marks; SUMMER 2024, 7 Marks; SUMMER 2025, 7 Marks)**
- **Q.** Explain application and advantages of various solar collectors / Compare flat plate collectors and concentrating collectors used in solar energy systems / Explain the different types of solar energy collectors used for industrial applications / Analyze the factors affecting the efficiency of solar collectors and suggest ways to improve it. **(SUMMER 2023, 7 Marks; WINTER 2024, 4 Marks; SUMMER 2026, 4 Marks)**

2. Solar Radiation:

- **Q.** Define: (i) Beam Radiation, (ii) Solar Altitude, (iii) Solar Azimuth Angle / Define the terms (I) Solar constant, (II) Concentration ratio, (III) Declination angle, (IV) Angle of Incidence / Define: (i) Solar constant (ii) Beam radiation (iii) Diffuse radiation. **(SUMMER 2022, 4 Marks; SUMMER 2023, 3 Marks; SUMMER 2024, 3 Marks; SUMMER 2025, 3 Marks)**
- **Q.** State various types of instruments for measuring solar radiation? Explain any one / How to measure solar radiation? **(SUMMER 2023, 4 Marks; WINTER 2025, 3 Marks)**

3. Solar Energy Storage and Solar Ponds:

- **Q.** Explain about solar energy storage system / Discuss classification of solar energy storage in detail / Explain various solar energy storage systems / Mention two methods of solar energy storage / Explain the chemical storage system for solar energy. **(WINTER 2022, 4 Marks; SUMMER 2023, 7 Marks; WINTER 2024, 3 Marks; SUMMER 2025, 7 Marks; WINTER 2025, 4 Marks)**
- **Q.** Short Note: Solar pond / Describe the principle of operation and working of solar ponds / Explain solar ponds / Suggest improvements for a solar pond system to enhance its energy storage capabilities. **(SUMMER 2023, 7 Marks; SUMMER 2024, 7 Marks; WINTER 2025, 4 Marks; SUMMER 2026, 4 Marks)**

4. Applications and Solar Thermal Systems:

- **Q.** List out applications of solar energy / Enlist various applications of solar energy / List various domestic and industrial applications of solar energy / List the application of solar energy. **(SUMMER 2022, 4 Marks; SUMMER 2023, 4 Marks; SUMMER 2024, 3 Marks; SUMMER 2025, 3 Marks; WINTER 2025, 4 Marks)**
- **Q.** Explain in brief about Solar distillation. **(SUMMER 2024, 4 Marks; SUMMER 2025, 4 Marks)**
- **Q.** Explain in brief about Solar pumping. **(SUMMER 2024, 4 Marks; SUMMER 2025, 4 Marks)**

Other Important Questions:

1. Solar Thermal Systems:

- **Q.** Describe any one type of the solar refrigeration system. **(WINTER 2022, 7 Marks)**
- **Q.** Describe any one type of the solar water heating system. **(WINTER 2022, 7 Marks)**

2. Solar Photovoltaic Systems:

- **Q.** Explain in detail the construction of solar cells, solar modules and solar arrays. **(SUMMER 2024, 7 Marks)**
- **Q.** Describe the principle of solar photovoltaic conversion and application. **(SUMMER 2025, 7 Marks)**

3. Design Problem:

- **Q.** Create an innovative solution that combines solar energy storage with electric vehicle charging stations. Detail the technology and feasibility. **(SUMMER 2026, 7 Marks)**

Chapter 4 – Fuel Cell

Repeated Questions:

1. Types and Classification of Fuel Cells:

- **Q.** State various types of fuel cells / Classify fuel cells. **(SUMMER 2023, 3 Marks; SUMMER 2025, 3 Marks)**
- **Q.** Describe Molten Carbonate Fuel Cell (MCFC) with neat diagram **(SUMMER 2022, 7 Marks; SUMMER 2023, 7 Marks; SUMMER 2024, 7 Marks; WINTER 2025, 7 Marks)**
- **Q.** List out desired properties of an ideal ion exchange membrane electrolyte / Explain the ion exchange membrane cell with a neat figure / Describe Ion exchange membrane cell with neat diagram / Assess the advantages and limitations of ion exchange membrane cells in fuel cell technology. **(SUMMER 2022, 7 Marks; WINTER 2022, 3 Marks; SUMMER 2024, 7 Marks; SUMMER 2025, 7 Marks; SUMMER 2026, 4 Marks)**

2. Advantages, Disadvantages and Applications:

- **Q.** Advantages and disadvantages of fuel cell / Discuss advantages and disadvantages of fuel cell / List out the disadvantages of the fuel cell / List the advantages and disadvantages of fuel cell technology. **(SUMMER 2022, 3 Marks; WINTER 2022, 7 Marks; SUMMER 2023, 4 Marks; WINTER 2025, 4 Marks)**
- **Q.** Give applications of fuel cell with explanation / Enlist the application of fuel cells / List applications of fuel cell / Discuss the application of fuel cell technologies. **(SUMMER 2022, 4 Marks; SUMMER 2023, 7 Marks; SUMMER 2024, 3 Marks; WINTER 2025, 4 Marks)**

3. Polarization and Electrodes:

- **Q.** Write a short note on conversion efficiency & polarization / Short note on polarization in a fuel cell / Define polarization in fuel cells. Why is it significant in evaluating fuel cell performance? **(SUMMER 2022, 3 Marks; WINTER 2022, 7 Marks; WINTER 2024, 3 Marks)**
- **Q.** Explain different types of electrodes in brief / Describe the different types of electrodes used in fuel cells and their roles in improving conversion efficiency / List the type of electrode used in the fuel cell. **(WINTER 2022, 4 Marks; WINTER 2024, 7 Marks; WINTER 2025, 3 Marks)**

Other Important Questions:

1. Principle, Working and Comparison:

- **Q.** State the principle and working of the fuel cell. **(SUMMER 2024, 3 Marks)**
- **Q.** Describe the basic operation of a hydrogen-oxygen fuel cell. **(SUMMER 2026, 3 Marks)**
- **Q.** Describe the working of a hydrogen-oxygen fuel cell with a neat diagram. Discuss its advantages and disadvantages. **(WINTER 2024, 7 Marks)**
- **Q.** Differentiate between hydrogen-oxygen fuel cell and fossil fuel cell. **(WINTER 2022, 4 Marks)**
- **Q.** Differentiate fuel cell and battery. **(SUMMER 2025, 4 Marks)**
- **Q.** Identify and describe one major advantage of molten carbonate fuel cells over traditional hydrogen-oxygen fuel cells. **(SUMMER 2026, 3 Marks)**

2. Efficiency and Design:

- **Q.** Explain the conversion efficiency of fuel cell energy. **(WINTER 2025, 3 Marks)**
- **Q.** Design a fuel cell-based power system for a remote location, detailing the type of fuel cell, energy storage, and distribution strategy. **(SUMMER 2026, 7 Marks)**

Chapter 5 – Energy from Biomass

Repeated Questions:

1. Biogas Generation and Biogas Plants:

- **Q.** What are the factors affecting biogas generation? / List contributing factors that affect biogas generation / Discuss the various factors affecting the design of a biogas plant / Which criteria have to be considered while designing of biogas digester? **(SUMMER 2023, 3 Marks; WINTER 2024, 4 Marks; SUMMER 2025, 3 Marks; WINTER 2025, 3 Marks)**
- **Q.** Short note: Types of biogas plant / Classify biogas plants based on process and design / List out the classification of biogas plants and explain the working of anyone with a neat sketch / List and briefly describe three types of biogas plants / Discuss in detail the floating holder biogas plants. **(SUMMER 2022, 7 Marks; SUMMER 2023, 7 Marks; SUMMER 2024, 4 Marks; SUMMER 2025, 7 Marks; SUMMER 2025, 4 Marks; WINTER 2025, 7 Marks; SUMMER 2026, 3 Marks)**
- **Q.** Describe construction and working of KVIC digester / Draw the flow sheet of the community biogas plant / Describe the design and working principle of a community biogas plant. Highlight its advantages and limitations / Create a proposal for a community-based biogas plant, including design considerations, expected energy output, and environmental benefits. **(WINTER 2022, 4 Marks; SUMMER 2023, 7 Marks; WINTER 2024, 7 Marks; SUMMER 2026, 7 Marks)**
- **Q.** Discuss the properties of biogas / List properties of biogas and explain the utilization of biogas. **(SUMMER 2022, 4 Marks; SUMMER 2024, 4 Marks)**

2. Biomass Conversion Processes:

- **Q.** Define pyrolysis and explain / Describe Pyrolysis system with neat figure / Explain pyrolysis of biomass. **(WINTER 2022, 7 Marks; SUMMER 2023, 3 Marks; SUMMER 2024, 4 Marks)**
- **Q.** Define Photosynthesis. What are the conditions necessary for photosynthesis? / Explain photosynthesis process and also write necessary conditions for it / Explain the role of photosynthesis in biomass energy conversion technology. **(WINTER 2022, 7 Marks; SUMMER 2023, 3 Marks; SUMMER 2026, 4 Marks)**
- **Q.** Discuss thermal gasification of biomass / What are the factors affecting the efficiency of thermal gasification of biomass? **(SUMMER 2024, 4 Marks; WINTER 2024, 3 Marks)**

Other Important Questions:

1. Biogas Plants:

- **Q.** Discuss the methods used to maintain the biogas production. **(WINTER 2025, 7 Marks)**
- **Q.** Which points need to be considered while selecting site for biogas plants? **(WINTER 2025, 3 Marks)**

2. Biomass Conversion and Environment:

- **Q.** Explain the different dry processes for biomass conversion. **(SUMMER 2022, 7 Marks)**
- **Q.** Explain Combustion of biomass. **(SUMMER 2025, 4 Marks)**
- **Q.** Analyze the environmental benefits of converting biomass to energy versus traditional fossil fuels. **(SUMMER 2026, 4 Marks)**

Chapter 6 – Wind Energy

Repeated Questions:

1. Site Selection and Wind Energy Systems:

- **Q.** List out the main considerations for site selection of wind energy? / List considerations for site selection of wind energy / Describe the main considerations in selecting a site for wind generators / List site selection criteria for the wind turbine installation. **(SUMMER 2022, 4 Marks; SUMMER 2023, 4 Marks; SUMMER 2025, 4 Marks; WINTER 2025, 3 Marks)**
- **Q.** Describe with a neat sketch the working of a wind energy system with main components / Describe the wind energy conversion system (WECS) and discuss the basic components involved in it / Discuss the basic components of wind energy conversion system. **(SUMMER 2024, 7 Marks; WINTER 2024, 7 Marks; SUMMER 2025, 7 Marks; WINTER 2025, 7 Marks)**
- **Q.** Discuss classification of WECS / Classify and explain the wind energy conversion system. **(WINTER 2022, 3 Marks; WINTER 2025, 7 Marks)**
- **Q.** Give applications of wind energy / Explain the applications of wind energy. **(SUMMER 2023, 7 Marks; WINTER 2025, 3 Marks)**

2. Wind Turbines:

- **Q.** Compare Horizontal axis wind turbine and vertical axis wind turbine. **(SUMMER 2024, 3 Marks; SUMMER 2025, 3 Marks)**
- **Q.** Classify various types of rotor used in the wind turbine. **(SUMMER 2024, 3 Marks; SUMMER 2025, 3 Marks)**

Other Important Questions:

1. Wind Characteristics and Power:

- **Q.** What is the nature of wind? **(SUMMER 2022, 3 Marks)**
- **Q.** Explain the power of wind for power generation. **(SUMMER 2022, 4 Marks)**
- **Q.** Explain the advantages and disadvantages of wind energy. **(SUMMER 2022, 4 Marks)**
- **Q.** Formulate and derive the Betz coefficient. Show each step and write your assumptions clearly. **(WINTER 2022, 7 Marks)**
- **Q.** Derive the formula for calculating maximum torque and maximum axial thrust. **(WINTER 2022, 7 Marks)**

2. Wind Turbine and WECS Principles:

- **Q.** Draw a neat sketch of a wind energy conversion system (WECS) with all components. **(SUMMER 2022, 3 Marks)**
- **Q.** Explain the pressure and velocity curves of wind passing through a horizontal axis wind turbine. **(SUMMER 2022, 4 Marks)**
- **Q.** Write down three reasons to control the rotor speed. **(WINTER 2022, 3 Marks)**
- **Q.** Describe the basic working principle of a wind energy conversion system. **(SUMMER 2025, 7 Marks)**
- **Q.** Outline the basic principle behind wind energy conversion systems. **(SUMMER 2026, 3 Marks)**
- **Q.** Explain the basic principles of wind energy and how site selection affects the efficiency of wind power generation. **(WINTER 2024, 7 Marks)**
- **Q.** Describe how the design of the turbine effect power generation from wind. **(SUMMER 2024, 7 Marks)**

3. Performance and Design:

- **Q.** Evaluate the impact of wind speed variations on the power output of wind turbines. **(SUMMER 2026, 4 Marks)**

- **Q.** Propose a design for a wind farm, including turbine selection, site analysis, and expected power generation. **(SUMMER 2026, 7 Marks)**

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