GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Name & Code: Fuels and Combustion - 3150509

Chapter 1: Introduction

Repeated Questions:

1. Fuel Classification, Characteristics & Examples:

- **Q.** Define fuel and discuss its classification with suitable example. / Define fuel and classify them by making a tree diagram. / Draw a line diagram for the classification of fuel. / Define fuel and classify them using block diagram. [Diagram required – refer to the original question paper] **(SUMMER 2023, 3 Marks; SUMMER 2024, 3 Marks; WINTER 2025, 3 Marks; SUMMER 2026, 3 Marks)**
- **Q.** State the characteristics of good fuel. / List out the various characteristics of a good fuel. **(WINTER 2022, 3 Marks; WINTER 2023, 3 Marks)**

2. Fuel Properties & Measurement:

- **Q.** Enlist any three properties of solid and liquid fuel. Also, Explain their measurement techniques in detail. **(SUMMER 2024, 7 Marks; WINTER 2024, 7 Marks)**

Other Important Questions:

1. Fuel Classification, Characteristics & Examples:

- **Q.** Cite any three industrial examples of solid, liquid and gaseous fuels. **(SUMMER 2022, 3 Marks)**
- **Q.** State any three industrial examples of solid, liquid and gaseous fuels. **(SUMMER 2025, 3 Marks)**

2. Fuel Properties & Measurement:

- **Q.** State the various properties and its measurement techniques for liquid fuels. **(SUMMER 2022, 4 Marks)**
- **Q.** Define flash point and fire point and explain the significance of both. **(SUMMER 2023, 4 Marks)**
- **Q.** Compare storage & handling of solid and liquid fuels. **(SUMMER 2022, 3 Marks)**
- **Q.** Define octane number and cetane number and discuss their significance. **(WINTER 2025, 4 Marks)**

Chapter 2: Solid Fuels

Repeated Questions:

1. Coal Formation, Coalification & Rank:

- **Q.** Discuss various theories suggested by geologists regarding the formation of coal. / Enlist the different theories behind the coal forming process. Describe anyone in detail. / Enlist different theories behind coal forming process. Describe in detail. **(SUMMER 2023, 7 Marks; SUMMER 2024, 4 Marks; WINTER 2024, 4 Marks; SUMMER 2026, 7 Marks OR)**

2. Coal Combustion & Gasification:

- **Q.** Discuss the different types of coal combustion techniques. / Write a short note on different types of coal combustion techniques. / State the different types of coal combustion techniques and explain any one in detail. / Enlist various coal combustion technologies. Explain circulating fluidized bed combustion technique for the combustion of bituminous coal. / Enlist coal combustion techniques. Explain fluidized bed combustion with neat sketch. Also, discuss the advantage of fluidized bed combustion over fixed bed combustion. [Diagram required – refer to the original question paper] **(SUMMER 2022, 7 Marks; WINTER 2022, 7 Marks; WINTER 2023, 7 Marks; SUMMER 2024, 7 Marks OR; SUMMER 2025, 7 Marks; WINTER 2025, 7 Marks)**

3. Coal Washing:

- **Q.** Explain float and sink method for coal washing. / Describe in brief the Float and Sink test for coal washing with neat sketch. [Diagram required – refer to the original question paper] **(SUMMER 2023, 4 Marks OR; WINTER 2024, 4 Marks; SUMMER 2026, 4 Marks)**
- **Q.** Enlist the different objectives and industrial applications of coal washing. Describe in brief the Float and Sink test for coal washing with neat sketch. / Enlist any four industrial applications of coal washing. / State the objectives of coal washing. [Diagram required – refer to the original question paper] **(WINTER 2022, 3 Marks; SUMMER 2024, 7 Marks; SUMMER 2025, 4 Marks)**

4. Coal Liquefaction & Coal-Based Liquid Fuels (MTG, F-T):

- **Q.** Discuss about the direct and indirect methods of coal liquefaction. / Define coal liquefaction process. Enlist various types of liquefaction process. / What is coal liquefaction? Why it is required? Discuss the direct and indirect process of coal liquefaction. / Differentiate between direct and indirect coal liquefaction process. / Differentiate between direct and Indirect coal liquefaction processes with suitable examples. **(SUMMER 2022, 7 Marks; SUMMER 2024, 4 Marks; WINTER 2024, 3 Marks; SUMMER 2025, 7 Marks; WINTER 2025, 4 Marks)**
- **Q.** Describe briefly MTG process. List out the advantages of ebullated bed reactor over the fixed bed reactor / Describe briefly H-coal process. List out the advantages of ebullated bed reactor over the fixed bed reactor / Describe Methanol to Gasoline process (MTG) for the production of clean gasoline via coal with suitable chemical reactions involved. **(SUMMER 2023, 7 Marks OR; WINTER 2025, 7 Marks OR; SUMMER 2026, 7 Marks OR)**

5. Coal Mining:

- **Q.** Explain auger mining. **(SUMMER 2024, 3 Marks; WINTER 2024, 3 Marks)**
- **Q.** Explain Long wall coal mining in detail. / Explain Long-Wall mining. **(WINTER 2024, 7 Marks OR; SUMMER 2026, 3 Marks)**
- **Q.** State the advantages and disadvantages of long-wall mining. / State the advantages and disadvantages of short-wall mining. **(SUMMER 2023, 3 Marks; SUMMER 2023, 3 Marks OR)**
- **Q.** Explain Short-Wall mining. **(SUMMER 2026, 3 Marks OR)**
- **Q.** Explain room and pillar mining. **(SUMMER 2024, 3 Marks OR)**

Other Important Questions:

1. Coal Mining:

- **Q.** State the types of mining and basic system of production techniques for mining. **(SUMMER 2025, 3 Marks)**
- **Q.** What is coal mining? State the types of mining and basic system of production techniques for mining. **(WINTER 2023, 3 Marks)**
- **Q.** Define coal mining. Explain Long wall coal mining in detail. **(WINTER 2024, 7 Marks OR)**
- **Q.** Explain the term coal mining. Enlist various types of coal mining. **(WINTER 2025, 3 Marks)**

2. Coal Properties, Quality & Scenario in India:

- **Q.** State the various important properties of coal. **(WINTER 2022, 3 Marks)**
- **Q.** Write a short note on scenario of coal reservoirs in India. **(WINTER 2022, 4 Marks)**
- **Q.** Discuss in detail about the scenario of coal reservoirs in India. Also, state the consumption pattern of coal in India **(SUMMER 2023, 7 Marks)**
- **Q.** Describe devolatilisation of coal at different temperature range. Also Discuss the composition of volatile matter. **(SUMMER 2023, 4 Marks)**
- **Q.** Explain proximate and ultimate analysis of fuel for the evaluation of various properties of coal. **(SUMMER 2026, 7 Marks)**
- **Q.** Write in brief about the proximate and ultimate analysis of coal. **(WINTER 2022, 7 Marks)**
- **Q.** Name the methods to assess the quality of coal and explain any one in detail. **(WINTER 2023, 7 Marks OR)**

3. Coal Formation, Coalification & Rank:

- **Q.** Describe the process of coalification. State the rank of coal with a block diagram. [Diagram required – refer to the original question paper] **(SUMMER 2024, 4 Marks)**
- **Q.** Illustrate the stages of coalification with the help of a diagram. [Diagram required – refer to the original question paper] **(SUMMER 2026, 4 Marks)**
- **Q.** Define rank of coal with neat flow chart. [Diagram required – refer to the original question paper] **(SUMMER 2026, 3 Marks)**

4. Coal Tar & Carbonization:

- **Q.** What is carbonization? How it is being carried out? State the different types of carbonization. **(WINTER 2023, 3 Marks)**
- **Q.** Explain the coal tar distillation process with neat sketch and also name the various products obtained during this process. [Diagram required – refer to the original question paper] **(WINTER 2024, 4 Marks OR)**
- **Q.** Draw neat flow diagram for coal tar distillation. [Diagram required – refer to the original question paper] **(SUMMER 2026, 4 Marks)**
- **Q.** State the disadvantages of crude coal tar as a furnace fuel. **(WINTER 2022, 3 Marks OR)**

5. Coal Combustion & Gasification:

- **Q.** Briefly describe the gasification process for coal. **(WINTER 2023, 4 Marks)**

6. Coal Liquefaction & Coal-Based Liquid Fuels (MTG, F-T):

- **Q.** Describe F-T synthesis process for the production of gasoline via coal with neat block diagram. [Diagram required – refer to the original question paper] **(SUMMER 2026, 7 Marks)**

Chapter 3: Liquid Fuels

Repeated Questions:

1. Storage & Handling of Liquid Fuels:

- **Q.** Briefly explain the storage and handling of liquid fuels. / Write a brief note on storage and handling of liquid fuel. / Write in short about storage and handling of liquid fuels. **(WINTER 2022, 4 Marks; WINTER 2023, 4 Marks; SUMMER 2025, 4 Marks)**

2. Refinery Products, Equipment, Properties & Scenario:

- **Q.** Enlist the refining products of petroleum. **(WINTER 2022, 4 Marks; SUMMER 2025, 3 Marks)**

3. Petroleum Refining Processes:

- **Q.** Explain visbreaking. Also list the various products of visbreaking unit. **(WINTER 2024, 4 Marks; WINTER 2025, 4 Marks)**
- **Q.** Explain the reforming of naphtha in detail with neat flow diagram. [Diagram required – refer to the original question paper] **(SUMMER 2024, 7 Marks OR; WINTER 2024, 7 Marks)**
- **Q.** Describe delayed coking process used in the petroleum refinery with neat flow sheet. [Diagram required – refer to the original question paper] **(WINTER 2024, 7 Marks OR; WINTER 2025, 7 Marks OR)**
- **Q.** Describe the vacuum distillation process with neat flow diagram / Describe vacuum distillation unit with neat flow sheet for crude distillation. [Diagram required – refer to the original question paper] **(SUMMER 2023, 7 Marks; WINTER 2025, 7 Marks)**
- **Q.** What is dewaxing? Discuss the different types of dewaxing processes. **(SUMMER 2022, 7 Marks OR; WINTER 2023, 7 Marks)**

4. Exploration, Drilling & Origin of Petroleum:

- **Q.** With neat sketch explain the drilling process of petroleum and natural gas. [Diagram required – refer to the original question paper] **(WINTER 2023, 7 Marks; SUMMER 2025, 7 Marks OR)**
- **Q.** Write a short note on accumulation of petroleum in sediments. **(WINTER 2022, 7 Marks OR; SUMMER 2023, 4 Marks)**
- **Q.** Write short note on improved oil recovery (IOR). **(WINTER 2024, 3 Marks OR; WINTER 2025, 3 Marks OR)**

Other Important Questions:

1. Exploration, Drilling & Origin of Petroleum:

- **Q.** Explain Seismic geophysical work in drilling operation. **(WINTER 2024, 3 Marks)**
- **Q.** Explain origin and classification of petroleum crude. **(SUMMER 2024, 3 Marks)**
- **Q.** Write short note on exploration of crude petroleum. **(WINTER 2025, 3 Marks)**

2. Refinery Products, Equipment, Properties & Scenario:

- **Q.** Discuss about the measurement techniques for petroleum fractions. **(WINTER 2023, 4 Marks)**
- **Q.** State the different types of refinery equipments along with their uses. **(WINTER 2023, 3 Marks)**
- **Q.** Discuss in detail about the present scenario of crude oil refineries in India. Also, state the consumption pattern of petroleum crude in India. **(WINTER 2025, 7 Marks)**
- **Q.** Write a technical note on the properties & testing of petroleum products. **(SUMMER 2022, 4 Marks)**

3. Petroleum Refining Processes:

- **Q.** Describe fluid catalytic cracking process in detail. Discuss the recent development in the catalysts for this process. **(SUMMER 2023, 7 Marks OR)**
- **Q.** Explain hydrocracking. Also list the various products of hydrocracking unit. **(WINTER 2025, 4 Marks OR)**

4. Storage & Handling of Liquid Fuels:

- **Q.** Explain the storage, handling and safety of gasoline. **(SUMMER 2023, 3 Marks)**

Chapter 4: Gaseous Fuels

Repeated Questions:

1. Producer Gas & Water Gas:

- **Q.** Define producer gas. Discuss the different reactions involved in the production of producer gas. / What is producer gas? Discuss the different reactions involved in the production of producer gas. / Discuss the different reactions involved in the production of producer gas. / Describe the synthesis of producer gas with all the chemical reactions involved and flow diagram. [Diagram required – refer to the original question paper] **(SUMMER 2022, 7 Marks; SUMMER 2023, 7 Marks OR; WINTER 2024, 7 Marks; SUMMER 2025, 7 Marks OR; WINTER 2025, 7 Marks)**
- **Q.** Define water gas. Describe the production of water gas with all reactions involved. / What is water gas? Discuss the different reactions involved in the production of water gas. / Describe the production of water gas with all chemical reactions involved. **(WINTER 2023, 4 Marks OR; WINTER 2024, 7 Marks OR; SUMMER 2026, 7 Marks)**

2. Acetylene, LPG & Other Gaseous Fuels:

- **Q.** Briefly explain the storage and handling of acetylene gas. / Discuss about the safety and handling of acetylene gas. / State the storage, handling and safety for acetylene gas. / Explain the storage, handling and safety of acetylene gas. **(SUMMER 2022, 3 Marks; WINTER 2023, 4 Marks OR; SUMMER 2024, 4 Marks OR; SUMMER 2025, 4 Marks OR; WINTER 2025, 4 Marks OR)**

3. Hydrogen Production:

- **Q.** Enlist various methods for hydrogen production. Explain any one in detail. / Enlist the various methods for the production of hydrogen gas. Describe the steam reforming process for the synthesis of hydrogen with all the chemical reactions involved. **(SUMMER 2024, 4 Marks OR; WINTER 2024, 4 Marks OR; WINTER 2025, 7 Marks OR)**

4. Biogas:

- **Q.** Define Biogas. Enlist the various steps involved in the biogas production. **(SUMMER 2023, 3 Marks; SUMMER 2024, 3 Marks; WINTER 2025, 3 Marks OR)**

Other Important Questions:

1. Acetylene, LPG & Other Gaseous Fuels:

- **Q.** Discuss about cleaning, purification and quality enhancement of gaseous fuels. **(SUMMER 2025, 7 Marks)**
- **Q.** Define LPG. List the various constituents of LPG. **(SUMMER 2026, 3 Marks)**
- **Q.** Write short notes on: (a) Refinery gas, (b) Blast furnace gas **(SUMMER 2026, 4 Marks)**
- **Q.** Enlist the techniques used for the removal of dust and ash particles from fuel gases. **(SUMMER 2026, 3 Marks OR)**
- **Q.** Describe the formation of methane in coal mines. Discuss its applicability as a fuel with safety. **(SUMMER 2026, 7 Marks OR)**

2. Producer Gas & Water Gas:

- **Q.** What is carbureted water gas? State the applications of carbureted water gas. **(SUMMER 2025, 3 Marks OR)**
- **Q.** Explain the storage, handling and safety of water gas. **(WINTER 2025, 4 Marks)**

3. Hydrogen Production:

- **Q.** Briefly explain the different reaction occur during the steam reforming. **(WINTER 2023, 3 Marks OR)**
- **Q.** Differentiate between steam reforming and partial oxidation process for producing hydrogen gas. **(SUMMER 2022, 4 Marks)**
- **Q.** Write short note on hydrogen as a clean fuel. **(SUMMER 2026, 4 Marks OR)**

4. Biogas:

- **Q.** Define biogas. **(WINTER 2025, 3 Marks OR)**

Chapter 5: Manufactured fuels

Repeated Questions:

1. Agro Fuels:

- **Q.** Define agro fuels. Explain the storage & handling procedure of agro fuels. / What are agro fuels? Explain the storage & handling procedure of agro fuels. / Explain the handling and storage of agro fuels. **(SUMMER 2022, 4 Marks OR; WINTER 2023, 4 Marks; WINTER 2024, 4 Marks OR)**

2. Bio-fuels (Ethanol & Bio-diesel):

- **Q.** Discuss in brief about production processes and technologies for bio-fuels. / Discuss the production process, technologies and applications of bio fuels. / Classify the bio fuels. Discuss the production process, technologies and applications of bio fuels. / Define bio-fuel. Describe in detail about the production processes and technologies available for ethanol production. **(SUMMER 2022, 7 Marks OR; WINTER 2022, 7 Marks; SUMMER 2023, 7 Marks; WINTER 2023, 7 Marks)**
- **Q.** Describe in detail about the production processes and technologies available for bio-diesel production. **(SUMMER 2024, 7 Marks)**

Other Important Questions:

1. Agro Fuels:

- **Q.** Write a short note on agro fuels. **(WINTER 2022, 4 Marks)**
- **Q.** Define Agro fuels with two examples. **(SUMMER 2023, 3 Marks OR)**
- **Q.** Define agro fuel with suitable examples. **(WINTER 2025, 3 Marks)**
- **Q.** With suitable examples differentiate between agro fuels and bio fuels. **(SUMMER 2025, 4 Marks)**

2. Bio-fuels (Ethanol & Bio-diesel):

- **Q.** Cite any three industrial applications of bio fuels. **(SUMMER 2022, 3 Marks OR)**
- **Q.** Enlist various generations for bio-fuel production. Also, discuss the various challenges faced in using Ethanol as a fuel in India **(SUMMER 2024, 3 Marks OR)**

Chapter 6: Stoichiometry of combustion

Repeated Questions:

1. Stoichiometry, Excess Air & Combustion Fundamentals:

- **Q.** Define stoichiometric air and excess air requirement for combustion. **(SUMMER 2024, 3 Marks OR; SUMMER 2025, 3 Marks; SUMMER 2026, 3 Marks OR)**
- **Q.** Briefly explain the mechanism and kinetics of combustion process. / State the mechanism and kinetics of combustion process. **(SUMMER 2022, 3 Marks; WINTER 2024, 3 Marks OR; SUMMER 2025, 4 Marks)**

2. Calorific Value:

- **Q.** What is net and gross calorific value of fuel? How to determine the calorific value at constant temperature? / Define calorific value, gross calorific value and net calorific value of fuel. **(WINTER 2024, 3 Marks; SUMMER 2025, 4 Marks)**

3. Adiabatic Flame Temperature & Dew Point:

- **Q.** What is adiabatic flame temperature? Derive an expression for constant pressure adiabatic flame temperature. / Define adiabatic flame temperature. / Define adiabatic flame temperature and dew point temperature. **(WINTER 2022, 3 Marks OR; SUMMER 2023, 3 Marks; SUMMER 2024, 3 Marks; WINTER 2024, 3 Marks OR; SUMMER 2025, 7 Marks)**
- **Q.** Derive the equation for constant pressure adiabatic flame temperature process. / Derive the equation for constant pressure adiabatic flame temperature. **(SUMMER 2022, 4 Marks; WINTER 2023, 4 Marks OR)**

4. Numerical Problems:

- **Q.** A coal sample on analyzing by weight gave carbon 85%, hydrogen 6%, oxygen 6% and remaining are incombustible gases. Determine minimum weight of air required per kg of coal for chemically correct composition. **(SUMMER 2023, 7 Marks; SUMMER 2024, 7 Marks)**
- **Q.** An ultimate analysis of gasoline sample gave carbon 85%, hydrogen 15%. Calculate the ratio of air to gasoline consumption by weight if the volumetric analysis of the dry exhaust gas is CO_2 = 11.5%; CO = 1.2%; O_2 = 0.9%; and N_2 = 86%. Also, determine the % of excess air required for complete combustion. / A petrol sample on analyzing by weight using an ultimate analysis gave carbon 85%, hydrogen 15%. Calculate the ratio of air to fuel by weight if volumetric analysis of the dry exhaust gas include CO_2; 11.5%, CO; 1.2%, O_2; 0.9% and N_2; 86%. Also find % excess air. / The following is the ultimate analysis of a sample of petrol by weight: Carbon = 85%; Hydrogen = 15%. Calculate the ratio of air to petrol consumption by weight if the volumetric analysis of the dry exhaust gas is: CO_2 = 11.5%; CO = 1.2 percent; O_2 = 0.9%; N_2 = 86%. Also find percentage excess air. **(SUMMER 2022, 7 Marks OR; SUMMER 2023, 7 Marks OR; WINTER 2024, 7 Marks; SUMMER 2026, 7 Marks OR)**

Other Important Questions:

1. Adiabatic Flame Temperature & Dew Point:

- **Q.** What is dew-point temperature? Explain the method to determine the dew-point temperature of the combustion products. **(SUMMER 2022, 4 Marks OR)**
- **Q.** Write short note on adiabatic flame temperature, calorific value of coal, air to fuel ratio and dew point of products. **(WINTER 2025, 7 Marks)**

2. Stoichiometry, Excess Air & Combustion Fundamentals:

- **Q.** Write down the basic chemical equations for complete combustion of fuel. **(WINTER 2023, 3 Marks OR)**
- **Q.** List out the factors affecting the rate of combustion process. **(WINTER 2023, 3 Marks)**

3. Numerical Problems:

- **Q.** The CO_2 content of the products of complete combustion of a coal of 7,200 kcal/kg CV is 12% by orsat analysis. Calculate: (a) % excess air (b) volume of air supply at 30°C and 760 mmHg and (c) volume of the flue gas leaving the furnace at 400°C and 760 mmHg per kg of coal fired. **(WINTER 2022, 7 Marks OR)**
- **Q.** Methane (CH_4) is burned with atmospheric air. The molar analysis of the products on a dry basis is as follows: CO_2 = 10% O_2 = 2.37% CO = 0.53% N_2 = 87.10%. Calculate the air-fuel ratio and the percent theoretical air required for complete combustion. **(WINTER 2022, 7 Marks OR)**
- **Q.** A petrol sample was found to have 86% carbon and 14% hydrogen by mass. When used in an engine the air supply is 90% of that theoretically required for complete combustion. Assuming that all the hydrogen is burnt and that the carbon burns to carbon monoxide and carbon dioxide so that there is no free carbon left, calculate the percentage analysis of dry exhaust gases by volume. **(WINTER 2023, 7 Marks OR)**
- **Q.** Determine the air-fuel ratio on both a molar and mass basis for the complete combustion of octane, C_8H_{18}, with (i) the theoretical amount of air and (ii) 150% theoretical air (50% excess air). **(WINTER 2023, 7 Marks)**
- **Q.** Gasoline is burned steadily with air in jet engine. Determine the air to fuel ratio and the percentage excess air used for combustion. Assume the complete combustion of gasoline. **(SUMMER 2022, 7 Marks)**
- **Q.** A sample of coal has the following composition by mass: Carbon (C) = 80%, Hydrogen (H) = 5%, Oxygen (O) = 6%, Sulphur (S) = 1%, Ash = 8%. Calculate the Gross Calorific Value (GCV) and Net Calorific Value (NCV) of the coal. **(SUMMER 2026, 7 Marks)**
- **Q.** On assuming complete combustion, a liquid fuel (1.000 kg basis) has the following elemental mass composition (dry, no free water): 1. C = 0.840 kg 2. H = 0.120 kg 3. S = 0.002 kg 4. O = 0.020 kg 5. N = 0.018 kg The dry air is having the molar composition of O_2 = 21.0% and N_2 = 79.0% (use the usual molar ratio N_2/O_2 = 3.76). The combustion is carried out at 1 atm and standard temperature for gas volumes at 25°C (298.15 K), and volume V_m = 24.465 m^3/kmol. Calculate the theoretical oxygen demand in kmol O_2 and stoichiometric air (kmol and kg) required for 1.000 kg fuel. Give the stoichiometric air/fuel mass ratio (A/F, mass basis). **(SUMMER 2026, 7 Marks)**

Chapter 7: Combustion Technology

Repeated Questions:

1. Fluidized Bed, Pulverized Fuel & Stoker Firing:

- **Q.** Discuss the working principle and industrial applications of Fluidized bed combustion process. / Briefly explain the working principle of fluidized bed combustion process. / Explain the working of fluidized bed combustion process. **(SUMMER 2022, 4 Marks; WINTER 2023, 4 Marks OR; SUMMER 2025, 7 Marks OR)**
- **Q.** State the industrial applications of pulverized fuel firing. / State the two advantages and disadvantages of pulverized fuel firing. **(WINTER 2024, 4 Marks; SUMMER 2025, 3 Marks; WINTER 2025, 4 Marks)**
- **Q.** Discuss in short about the stoker firing. **(WINTER 2022, 3 Marks; SUMMER 2023, 3 Marks OR; SUMMER 2026, 3 Marks)**
- **Q.** Discuss the working and industrial application of traveling grate stoker boiler. **(SUMMER 2024, 4 Marks; WINTER 2024, 7 Marks OR; WINTER 2025, 7 Marks OR)**

2. Burners:

- **Q.** With neat sketch discuss the working mechanism and industrial applications of atmospheric gas burners. / Explain with neat sketch the atmospheric gas burner. [Diagram required – refer to the original question paper] **(WINTER 2022, 4 Marks; SUMMER 2025, 7 Marks)**
- **Q.** Explain turn down ratio of burner. State the various types of gas burner with their application. / Define turn down ratio of burner. State the various types of gas burner with their applications. **(SUMMER 2022, 3 Marks OR; SUMMER 2023, 4 Marks OR; SUMMER 2024, 4 Marks OR; WINTER 2025, 4 Marks OR; SUMMER 2026, 4 Marks OR)**
- **Q.** State the various types of gas burner. **(WINTER 2022, 4 Marks OR)**

3. Furnaces:

- **Q.** Enlist the various characteristics of an efficient furnace. / List out the various characteristics of an efficient furnace. **(SUMMER 2023, 4 Marks OR; WINTER 2024, 3 Marks; WINTER 2025, 3 Marks; SUMMER 2026, 4 Marks)**

4. Oxy-Rich Combustion:

- **Q.** Explain the oxy-rich combustion and discuss its significance. / Define oxy-rich combustion and discuss its significance. / State the potential benefits of oxygen enrich combustion over conventional air-fired combustion process. / State any three potential applications of oxygen rich combustion. / Define oxy-rich combustion. **(SUMMER 2022, 3 Marks; SUMMER 2023, 4 Marks; SUMMER 2024, 4 Marks; WINTER 2024, 4 Marks; WINTER 2025, 3 Marks OR; SUMMER 2026, 4 Marks OR)**

5. Flames, Heat of Combustion & Combustion Fundamentals:

- **Q.** Differentiate between diffusion flames and premixed flames. / Briefly discuss diffusion flames and premixed flames. **(SUMMER 2023, 4 Marks; SUMMER 2025, 4 Marks OR)**

Other Important Questions:

1. Furnaces:

- **Q.** State the two advantages and applications of walking hearth furnace. **(SUMMER 2025, 4 Marks OR)**
- **Q.** Why do furnaces operate at low efficiency? What are the methods by which furnace efficiencies can be improved? **(SUMMER 2025, 3 Marks OR)**
- **Q.** Name the various types of furnace and explain the working of any one. **(SUMMER 2022, 4 Marks OR)**

2. Flames, Heat of Combustion & Combustion Fundamentals:

- **Q.** Define heat of combustion, heat of reaction and heat of formation. **(SUMMER 2025, 3 Marks OR)**
- **Q.** Write in short about thermodynamic heat of combustion. **(WINTER 2022, 4 Marks OR)**
- **Q.** Discuss in short spontaneous ignition temperature. **(WINTER 2022, 3 Marks)**
- **Q.** State the types of combustion process and explain any one in detail. **(WINTER 2022, 7 Marks)**
- **Q.** Write in brief about velocity of flame propagation. **(WINTER 2022, 7 Marks)**
- **Q.** Briefly explain about flame structure, propagation and flammability limit. **(WINTER 2023, 4 Marks)**
- **Q.** Define enthalpy of combustion and formation. Derive the expression for the first law analysis of reacting system for the steady flow processes **(WINTER 2023, 3 Marks OR)**
- **Q.** State the characteristics of a good combustion process. **(SUMMER 2022, 3 Marks OR)**
- **Q.** Derive the expression for the first law analysis of reacting system for the steady flow processes. **(SUMMER 2022, 7 Marks)**
- **Q.** With neat sketch discuss about the structure and propagation for laminar premixed flame. [Diagram required – refer to the original question paper] **(SUMMER 2022, 7 Marks OR)**

3. Fluidized Bed, Pulverized Fuel & Stoker Firing:

- **Q.** State the various types of coal burning equipment. **(WINTER 2022, 3 Marks OR)**

4. Burners:

- **Q.** Explain with neat sketch the pot type burner. [Diagram required – refer to the original question paper] **(WINTER 2022, 4 Marks OR)**

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