

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V (NEW) EXAMINATION – WINTER 2021****Subject Code:3150509****Date:15/12/2021****Subject Name:Fuels and Combustion****Time:02:30 PM TO 05:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) Briefly explain various important properties of coal.	03
	(b) Discuss the history of all solid, liquid and gaseous fuels.	04
	(c) Crude oil is analyzed to contain 87% carbon, 12.5% hydrogen and 0.5% sulfur by weight. Calculate the net calorific value of crude oil at 298 K. Data: Gross calorific value of Crude oil at 298 K is 45071kJ/kg oil and latent heat of water vapor at same temperature is 2442.5 kJ/kg.	07
Q.2	(a) Describe the present status and consumption pattern of solid fuel.	03
	(b) Enlist the different theories behind the coal forming process. Describe anyone in detail.	04
	(c) Describe briefly H-coal process. List out the advantages of ebulated bed reactor over the fixed bed reactor.	07
OR		
	(c) Explain the coal gasification techniques in detail with neat sketch.	07
Q.3	(a) Define calorific value, gross calorific value and net calorific value of a fuel	03
	(b) Describe devolatilisation of coal at different temperature range. Also Discuss composition of volatile matter.	04
	(c) Describe the atmospheric distillation process with neat flow diagram.	07
OR		
Q.3	(a) Enlist the difference between the hydrocarbon products obtained as liquid fuel from Fischer Tropsch process and MTG process. Write the chemistry involved in MTG process.	03
	(b) Briefly explain the storage and handling of hydrogen gas.	04
	(c) Differentiate between fluid coking and delayed coking.	07
Q.4	(a) Explain the applications, limitations and benefits of biogas.	03
	(b) Discuss briefly about the direct and in-direct coal liquefaction processes.	04
	(c) Define bio-fuel. Describe in detail about the production processes and technologies available for bio-fuels production.	07
OR		
Q.4	(a) Enlist the various steps involved in the biogas production.	03
	(b) Explain the working principal of fluidized bed combustion process and also discuss the selected industrial applications of fluidized bed combustion process.	04
	(c) Describe fluid catalytic cracking process in detail. Discuss the recent development in the catalysts for this process.	07
Q.5	(a) Write the various reactions involved in the production of producer gas.	03
	(b) Describe the mechanism and kinetics of combustion.	04

- (c) A coal with a dry, ash free composition of 0.87 C, 0.09 H₂, 0.02 S, and 0.02 O₂ is burned with 25% excess air. The as fired ash and moisture contents are 6% and 4% respectively. Calculate the actual air-fuel ratios. **07**

OR

- Q.5** (a) Define oxy-rich combustion. **03**
- (b) Explain turn down ratio of burner. State the various types of gas burner with their applications. **04**
- (c) The Orsat analysis of the flue gases from a boiler house chimney by volume given below: CO₂: 11.4%, O₂: 4.2% and N₂: 84.4%, assuming that complete combustion takes place, **07**
- (a) Calculate the % excess air and
- (b) Find the C:H ratio in the fuel
