Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – SUMMER 2024

Subject Code: 3150509 Date:16-05-2024

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)**	Define fuel and classify them by making a tree diagram.	**03**
	(b)	Discuss various theories suggested by geologists regarding the formation of coal.	**04**
	(c)	Enlist any three properties of solid and liquid fuel. Also, Explain their measurement techniques in detail.	**07**
Q.2	**(a)**	Explain origin and classification of petroleum crude.	**03**
	(b)	Describe the process of coalification. State the rank of coal with a block diagram.	**04**
	(c)	Enlist the different objectives and industrial applications of coal washing. Describe in brief the Float and Sink test for coal washing with neat sketch.	**07**
		OR	
	(c)	Enlist coal combustion techniques. Explain fluidized bed combustion with neat sketch. Also, discuss the advantage of fluidized bed combustion over fixed bed combustion.	**07**
Q.3	**(a)**	Explain augur mining.	**03**
	(b)	Differentiate between direct and in-direct coal liquefaction process.	**04**
	(c)	Describe the vacuum distillation process with neat flow diagram.	**07**
		OR	
Q.3	**(a)**	Explain room and pillar mining.	**03**
	(b)	Briefly explain the storage and handling of acetylene gas.	**04**
	(c)	Explain the reforming of naphtha in detail with neat flow diagram.	**07**
Q.4	**(a)**	Define Biogas. Enlist the various steps involved in the biogas production.	**03**
	(b)	Explain the oxy-rich combustion and discuss its significance.	**04**
	(c)	Describe in detail about the production processes and technologies available for bio-diesel production.	**07**
		OR	
Q.4	**(a)**	Enlist various generations for bio-fuel production. Also, discuss the various challenges faced in using Ethanol as a fuel in India	**03**
	(b)	Explain turn down ratio of burner. State the various types of gas burner with their application.	**04**

	(c)	Define water gas. Describe the production of water gas with all reactions involved with schematic diagram.	**07**
Q.5	**(a)**	Define adiabatic flame temperature.	**03**
	(b)	Discuss the working and industrial application of traveling grate stoker boiler.	**04**
	(c)	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.	**07**

OR

Q.5	**(a)**	Define stoichiometric air and excess air requirement for combustion.	**03**
	(b)	Enlist various methods for hydrogen production. Explain any one in detail.	**04**
	(c)	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.	**07**

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