Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–V (NEW) EXAMINATION – WINTER 2020

Subject Code:3150509 Date:22/01/2021

Subject Name:Fuels and Combustion

Time:10:30 AM TO 12:30 PM Total Marks: 56

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	State the different characteristics of a good fuel required for combustion.	**03**
	(b)	Discuss in short about the scenario of coal reservoirs in India.	**04**
	(c)	Write in brief about the theories suggested by geologists regarding the mechanism of formation of coal.	**07**
Q.2	**(a)**	Briefly explain various important properties of coal.	**03**
	(b)	State the different objectives and industrial applications of coal washing.	**04**
	(c)	Write a short note on origin of petroleum and natural gas.	**07**
Q.3	**(a)**	Name the types of crude distillation methods used in petroleum industries.	**03**
	(b)	Enlist the refining products of petroleum.	**04**
	(c)	What are bio-fuels? Discuss in detail about the production process and technologies required for bio-fuels.	**07**
Q.4	**(a)**	Name the various methods to produce the hydrogen gas.	**03**
	(b)	Briefly explain the storage and handling of acetylene gas.	**04**
	(c)	What is producer gas? Discuss the different reactions involved in the production of producer gas.	**07**
Q.5	**(a)**	Explain the consequence of presence of nitrogen during combustion process.	**03**
	(b)	Define air to fuel ratio. Determine the air to fuel ratio when octane (C_8H_{18}) is burned with 200% theoretical air.	**04**
	(c)	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%, O_2 = 0.9%, N_2 = 86%. Also find percentage excess air.	**07**
Q.6	**(a)**	Define calorific value, gross calorific value and net calorific value of fuel.	**03**
	(b)	Calculate the heating value of Methane. It may be assumed the methane is burnt in pure oxygen and does not contain any water vapour. The reaction stoichiometry is $$CH_{4\,(g)} + 2O_{2\,(g)} \rightarrow CO_{2\,(g)} + 2H_2O_{\,(g)}$$ The heat of formation data are as follows: $\Delta H°_f$ of $CO_{2\,(g)}$ = –393.5 kJ/mol, $\Delta H°_f$ of $H_2O_{\,(g)}$ = –242.8 kJ/mol and $\Delta H°_f$ of $CH_{4\,(g)}$ = –74.8 kJ/mol	**04**
	(c)	Derive the expression for the first law analysis of reacting system for the steady flow processes.	**07**
Q.7	**(a)**	Briefly discuss the combustion of oil.	**03**
	(b)	State the two advantages and disadvantages of pulverized fuel firing.	**04**
	(c)	With neat sketch explain the concept of flame structure, propagation and	**07**

flammability limit.

Q.8	**(a)**	List out the various characteristics of an efficient furnace.	**03**
	(b)	What do you mean by turn down ratio of burner? State the various types of gas burner with their applications.	**04**
	(c)	With neat diagram discuss the working and industrial applications of fluidized bed combustion process.	**07**

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