Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER IV (NEW) – • EXAMINATION – SUMMER 2016

Subject Code: 2743901 **Date:04/05/2016**

Subject Name: Biomass Energy Conversion

Time:10:30 am to 01:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	An internal combustion engine burns liquid octane (C_8H_{18}) and uses 150% theoretical air. The fuel enters at 25^0C, air enters at 300 K and product leaves the engine exhaust port at 900 K. In the engine, 80% of carbon burns to form CO_2 and remainder burns to form CO. The heat transfer from the engine is just equal to the work done by the engine. Determine the power output (in kW) of engine if the engine burns 0.006 Kg / sec fuel. Obtain the combustion equation using principle of mass conservation.	**08**
	(b)	Determine the basic dimensions of a biogas plant to supply a biogas for the cooking need for a community center. Plant capacity = 200 m^3, Gas yield = 72 liters per day, retention period = 27 days, charge density = 913 kg/m^3, roof area factor = 1.04, roof volume factor = 1.03 and fraction of daily gas production = 0.6.	**06**
Q.2	**(a)**	Find the chemical reaction for the ETBE fuel ($(CH_3)_3COC_2H_5$) react with 130% theoretical air using principle of mass conservation. Calculate the Air-fuel ratio on mole basis and mass basis. Also do the product analysis on mass basis, dry and wet basis.	**07**
	(b)	Explain the LBL direct liquefaction process with neat and clean process diagram.	**07**
		OR	
	(b)	Write a governing equation for pyrolysis liquefaction and explain in brief Hydrothermal liquefaction.	**07**
Q.3	**(a)**	Write a short note on Marine biomass.	**07**
	(b)	Discuss in brief the activities involves in operation of energy farm.	**07**
		OR	
Q.3	**(a)**	Define the physical conversion process. Explain dewatering process for biomass and discuss the methods of dewatering.	**07**
	(b)	Explain the photosynthesis process for biomass.	**07**
Q.4	**(a)**	Define Pyrolysis. Explain (1) Pathways for the pyrolysis of cellulose (2) Process of thermal degradation of cellulose.	**07**
	(b)	Discuss the following factors affecting the generation of biogas: (1) pH (2) Seeding (3) Carbon Nitrogen ratio (4) Type of feedstock (5) Water table.	**07**
		OR	

Q.4	**(a)**	Explain in brief the following downstream processing in gasification process, (1) Gas purification (2) Shift conversion.	**07**
	(b)	Explain the working of fixed dome type biogas plant with neat and clean sketch.	**07**
Q.5	**(a)**	Explain the principle of ethanol fermentation. Explain in brief the microbial metabolic pathways leading to pyruvate formation and ethanol formation.	**07**
	(b)	Explain the feed stock preparation process for cereal grain for ethanol fermentation with neat and clean layout.	**07**

OR

Q.5	**(a)**	Define the conversion efficiency. Explain for the independent plant and integrated plant.	**07**
	(b)	Explain the batch type ethanol fermentation with neat and clean layout.	**07**

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