

Centre for Energy Studies

FUEL TECHNOLOGY, ESL-711

Time : hr.

Minor – II (9.5.2007)

MM : 45

Answer Part A and Part B in Separate Answer Sheet

1. (i.) Calculate the average gross calorific value and the Wobbe Index of a fuel gas with the following composition, percent by volume : methane 89.0, ethane 8.0, Propane 2.0 and butane 1.0. Given: Gross Cal. Values:

	Kcal/Nm ³ (dry)
Methane	9500
Ethane	16, 644
Propane	23, 688
Butane	30, 714

Sp. Gravity of air = 1

(3)

- (ii) Volumetric Composition of dry flue gas (on analysis) by burning a fuel containing only H & C is give below:

CO ₂	= 11.0%
O ₂	= 4.5%
N ₂	= 82%

Calculate

- (a) % composition of fuel by weight
- (b) % excess air used by volume
- (c) kg of air required / kg of fuel

(6)

- (iii) A sample of coke containing 60% C and 40% ash by weight is combusted with 20% excess air by volume. Calculate the volumetric flue gas composition per 100 kg of coke.

(3)

2. (A) What would be the components of the producer gas from a coal based counter current packed bed producer when

- (a) Temperature is low
- (b) In presence of Steam
- (c) In absence of Steam

(B) Write notes on any four

- (i) Different manufactured gases
- (ii) The gasification process that produces tar-free gas.
- (iii) Vis breaking
- (iv) Fisher- Tropsch process
- (v) FCC process
- (vi) Shape and size of a flame

(8)

3. Explain the following:

- (a) Surface combustion has wider application than pulsating combustion.
- (b) What will happen to a combustion process in a chamber where all parts do not have sufficient temperatures.
- (c) Why is black smoke generated and how to get rid of it. ?
- (d) Why FCC Process has been adopted by most refineries though several other processes exist.

(4)

PART B

- 1.a) Find out the grade of Karanpura Diwar Khan noncoking coal having the following analysis: moisture = 3.2%, ash = 32%, Volatile matter = 27%; C = 79.2%, H = 5.1%, N = 1.3%, S = 0.6%, O (balance). Also suggest its rank as per the classification of Indian coals.

(4)

- (b) Calculate the % excess air in the case of complete combustion of Talchar Coal. the analysis of the flue gas is as follows:

$$\% \text{N}_2 = 83.2\%, \text{O}_2 = 5.9\%, \text{CO}_2 = 11\%, \text{CO} = 0\%, \text{CH}_4 = 0\%$$

(1)

2. Calculate the calorific value of (CV) of the Bachra coal having the following analysis : moisture = 4.1%, Volatile matter = 28%; ash = 38%; C = 78.5%, H = 4.9%, N = 1.3%, S = 0.6%, O (balance), by applying the (i) CFRI formula and (ii) Seylor's formula. The CV determined experimentally was found to be 6989 K. cal/kg. Find out the % error in the calculation of CV by both the formulas.

(5)

3. Write short notes on the following topics:

- (a) Mechanism of combustion of carbon
- (b) Fine crushing of coal for the pulverized fuel (Coal) firing for Power generation in thermal power stations
- (c) Dry cleaning of coals.

(6)

4. Describe, how can the power be generated by fusion reactions and what are the problems in this.

(2)