Centre for Energy Stndies

Fuel Technology

Major Test

Time : 2 hrs.

PART : A (22 MAKRS)

1. Determine % Vol. Composition of flue gas when an air dried coal of following composition (% by wt.) burns with 50% excess air

Prox. Anal. (% air dried)	Ultimate Anal. (% dry ash free)
M = 8	C = 81
Ash = 20	H = 4.6
VM = 28.5	N = 1.8
FC = 43.5	S = 0.6
	O = 12 (6)

2. a) Indicate the differenees between the origin of petroleum and coal (1)

   b) What is the main eriteria for classifying petroleum crude as "Asphalt base' and 'paraffin base' (1)

   c) Write down two characteristic properties of "Bombay crude" and "Cambay crude". (1)

   d) Differentiate between : (6)

      i) Aniline point and Flash point
      ii) Pour point and Smoke point
      iii) Carbon residue and Char value

   clearly explaining the significance of each w.r.t. Petroleum fractions.

3. a) The following processes are involved in petroleum refining. Discuss the purpose of each process giving examples :

      i) Super fractionation
      ii) Visbreaking
      iii) Reforming
      iv) Isomerization (4)

   b) Write a brief note on "ARGE Process' (2)

PART : B (18 MARKS)

1. Calculate the calorific value (in MJ/kg) of the North karanpura coal having the following analysis (on air dried basis) : C=65 %, H = 4.1 %, N=1.4 %, S=0.6%, O by balance, moisture = 1.9 %, ash = 34%, volatile matter = 29%, by applying CFRI formula.
   Calculate the % error when the calorific value determined by Bomb Calorimeter was found to be 16 MJ/Kg. (6)

2. Write short notes on the following :

   a) Safe storage of coals in ultra mega thermal power stations
   b) Spiral separator
   c) Types of nuclear power reactors. (6)

3. Calculate the volume of theoretical oxygen and air required in Nm^3 (by applying quick combustion calculations for thecomplete combustion of Bachra Coal per kg. The analysis of the coal on air dried basis : C= 78%, H = 4.3%, S=0.5%, N=1.7%, O by balanec; moisture = 4.3% volatile matter = 29.2 %, ash = 33.6 %. (4)

4. Describe what is forth floatation and what are its limitation in terms of cleaning coals. (2)

Part – C (10 marks)

1. a) In a most well studied system for combustion mechanism explain 1st, 2nd and 3rd explosion limits. Does the surrounding environment affect any of them? (3)

   b) Calculate the inflammability of a gas mixture containing tbe following gases :

Given

	%	LEL	UEL
Ammonia	10	16.0	25.0
Butane	15	1.9	8.5
Methane	20	5.0	14.0
Gasoline	25	1.3	7.6
Nitrogen	10		
Carbon dioxide	10		
Argon	10		

(3)

   c) Answer the following with justification :

      i) With increase in jet velocity laminar flame changes (1)

      ii) In blow off condition of a flame how would V_u and $V_n \sin \alpha$ can be related ? (2)

      iii) Some gases from coal are manufactured to be used as fuels. Give details. (2)