ENERGY ENGINEERING
(CHEN 2103)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

   (i) Reagent used for froth flotation is
   (a) cresol (b) water (c) SBR (d) petroleum.

   (ii) High temperature carbonization is carried out at
   (a) 200°C (b) 1100°C (c) 500°C (d) 2000°C.

   (iii) Berrisford separator is used for coal
   (a) cutting (b) screening (c) washing (d) separation.

   (iv) A fuel cell, in order to produce electricity, burns
   (a) helium (b) hydrogen
   (c) nitrogen (d) carbon dioxide.

   (v) The principal component of coke oven gas is
   (a) methane (b) carbon monoxide
   (c) hydrogen (d) nitrogen.

   (vi) A renewable source of energy is
   (a) coal (b) petroleum
   (c) solar energy (d) coal bed methane.

   (vii) Cetane number is a measure of anti-knocking property of
   (a) gasoline (b) diesel oil (c) kerosene (d) fuel oil.

   (viii) Blue gas is nothing but
   (a) producer gas (b) blast furnace gas
   (c) water gas (d) hydrogen.

   (ix) Bomb calorimeter is used for the determination of calorific value of
   (a) gaseous fuel (b) solid fuel
   (c) liquid fuel (d) both solid and liquid fuels.

   (x) Which will has the least volatile matter and hence difficult to ignite?
   (a) coke (b) bituminous coal
   (c) lignite (d) peat.

Group – B

2. Write short notes on any four of the following: **4 × 3 = 12**
   (i) Jig washer
   (ii) Froth flotation
   (iii) Conventional energy source
   (iv) Oxidation loss of coal
   (v) Low temperature carbonization of coal.

3. (a) Briefly describe the proximate and ultimate analyses method of coal. Write a brief note on energy scenario in India.

   (b) Write down the features of LTC and HTC.

   (6 + 2) + 4 = 12

Group – C

4. (a) Explain the role of desalter unit in a petroleum refinery.

   (b) Write short notes on hydro treating and catalytic reforming.

   (c) Explain the role of soaker drum in a delayed coking unit. What are the advantages of fluidized bed catalytic cracking over fixed bed catalytic cracking?

   3 + (2 + 2) + (3 + 2) = 12

5. (a) With a net schematic diagram, describe the flash zone, ratification zone and stripping zone in a crude distillation unit.

   (b) Describe the different characterization techniques of petroleum fractions.

   (c) Define aniline point of a fuel oil and diesel index.

   3 + 6 + 3 = 12

Group – D

6. (a) Name different gaseous fuels. State advantages and disadvantages of gaseous fuels over liquid fuels.

   (b) Define wobbe index and state its importance?

(c) How the flame speed of gaseous fuel is determined?

(2 + 4) + 4 + 2 = 12

7. (a) What is Coal Bed Methane? What are the impacts of coal bed methane extraction on environment?

(b) What is syngas? Describe the Integrated Gasification Combined Cycle (IGCC).

(1 + 3) + (1 + 7) = 12

Group – E

8. (a) What is fuel cell? Explain the working principle of PEM fuel cell.

(b) What are the components present in a PEM fuel cell?

(c) Give the classification of solar collectors.

3 + 4 + 5 = 12

9. (a) What is the composition of biogas? Mention the factors affecting the generation of biogas.

(b) Explain with a schematic diagram the open cycle OTEC.

6 + 6 = 12