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

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

(iii) Coal washing is required to reduce
(a) volatile matter (b) ash content
(c) moisture content (d) sulphur content.

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

(v) Nuclear fuels are used in a nuclear reactor as
(a) control rod (b) fuel rod
(c) dust (d) lump.

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

(vii) Catalyst used in catalytic cracking is
(a) vanadium pent oxide (b) silica alumina
(c) silica gel (d) Platinum.

(viii) The solar cells convert the sunlight directly into.....energy
(a) thermal (b) electrical
(c) mechanical (d) chemical.

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

(x) 1,4-D-Glucopyranose is a part of
(a) coal (b) biomass
(c) cellulose (d) hemicellulose.

Group - B

2. (a) What is peat? Describe the formation of peat by natural process. Describe the coal cleaning process using Baum jig washer.

(b) A coal from Jharia colliery gave the following proximate analysis: moisture content 1.6%, ash content 15.7%, volatile matter 27.8%, and fixed carbon 54.9%. Calculate its ash on dry basis and volatile matter of d.a.f and d.m.m bases.

(1 + 2 + 5) + 4 = 12

3. (a) Define coke-oven battery. Draw a schematic diagram of coke-oven plant.

(b) Describe the Lurgi-Spiil gas low temperature carbonization.

(c) Write the difference between low temperature carbonization (LTC) and high temperature carbonization (HTC).

(2 + 2) + 5 + 3 = 12

Group - C

4. (a) Describe the flash zone, ratification zone, and stripping zone in a crude distillation unit with a net schematic diagram.

(b) Describe the characterization techniques of petroleum products namely smoke point, char vale, pour point, cloud point, flame height.

(c) Define viscosity index of lube oil. What is total acid number (TAN) of petroleum products?

3 + 6 +(2 + 1) = 12

5. (a) What is drilling rig? Describe the different types of drilling technology for the crude oil extraction.

(b) Describe the importance of coking and visbreaking operations in a petroleum refinery.

(1 + 2 + 2 + 2) + (2 + 3) = 12

Group - D

6. (a) Describe production of methane using anaerobic digestion of wastes with flowsheet.

(b) Describe the different factors affecting the anaerobic digestion under standard conditions.

7 + 5 = 12

7. (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

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) Describe the working principle of different types of solar collectors.

3 + 4 + 5 = 12

9. (a) Write a short note on solar pond and utilization of geothermal energy.

(b) What is the basic principle of photovoltaic cell?

6 + 6 = 12