

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) Coal washing is required to reduce

(a) volatile matter	(b) ash content
(c) moisture content	(d) sulphur content.
- (ii) Bomb calorimeter is used for the determination of calorific value of the

(a) gaseous fuel	(b) solid fuel
(c) liquid fuel	(d) both solid and liquid fuels.
- (iii) A module in a solar panel refers to

(a) series arrangement of solar cells	(b) parallel arrangement of solar cells
(c) series and parallel arrangement of solar cells	(d) none of (a), (b) and (c).
- (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) A fuel cell, in order to produce electricity, burns

(a) helium	(b) hydrogen
(c) nitrogen	(d) carbon dioxide.

- (viii) Berrisford separator is used for coal

(a) cutting	(b) screening
(c) washing	(d) separation.
- (ix) High temperature carbonization is carried out at

(a) 200 °C	(b) 1100 °C
(c) 500 °C	(d) 2000 °C.
- (x) Crude benzol is

(a) light oil	(b) heavy oil
(c) viscous oil	(d) both (b) and (c).

Group – B

2. (a) Describe the Beehive coke-oven process for the coke production.
- (b) Define Hitt's law. Describe the float and sink test for the coal cleaning process.

6 + 6 = 12

3. (a) Describe the classification of coal. Write the difference between the humic coal and sapropelic coal.
- (b) What is the source of mineral matter in the coal? How to find mineral matter using Parr formula?
- (c) Define Cannel coal and Boghead coal.

(2 + 2) + (2 + 2) + 4 = 12

Group – C

4. (a) Describe the flash zone, ratification zone, and stripping zone in a crude distillation unit with a neat schematic diagram.
- (b) Describe the characterization techniques of petroleum products namely smoke point, char value, pour point, cloud point and 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) Explain the formation of crude oil reservoir.
- (b) Discuss the different stage of crude oil processing using atmospheric distillation unit (ADU) and vacuum distillation unit (VDU).

3 + 9 = 12

Group – D

6. (a) Write the short notes on water gas and carbureted water gas.
(b) What is producer gas? Describe briefly how producer gas is manufactured.
(c) How do you classify the gaseous fuels? What is coke oven gas?

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

7. (a) What is the source of Coal Bed Methane? Describe the environmental effects of coal bed methane extraction.
(b) Write the composition of syngas. Describe the Integrated Gasification Combined Cycle (IGCC).

$$6 + 6 = 12$$

Group – E

8. (a) Explain the working principle of polymer electrolyte membrane fuel cell.
(b) Describe the working principle of different types of heliostat and concentrator solar collectors.

$$4 + 8 = 12$$

9. (a) What is biogas? Mention the factors affecting the generation of biogas.
(b) What is the basic principle of photovoltaic cell?

$$(2 + 6) + 4 = 12$$