B.TECH/CHE/3RD SEM/CHEN 2103/2016

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 with high volatile matter content
(a) has lower calorific value
(b) does not ignite easily
(c) gives less quantity of coke-oven gas
(d) has higher calorific value.

(ii) Mineral matter content of Indian coal is
(a) 20% higher than its ash content
(b) 10% higher than its ash content
(c) 5% higher than its ash content
(d) not related to its ash content.

(iii) Catalyst used in catalytic cracking
(a) vanadium pentoxide (b) silica alumina
(c) silica gel (d) none of these.

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

(v) Octane number is a measure of anti-knocking characteristic of
(a) diesel oil (b) gasoline
(c) kerosene (d) none of these.

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

(vii) Pulsating movement of water in a Baum Jig Washer is created by
(a) reciprocating plunger,
(b) admitting and releasing compressed air,
(c) either (a) or (b),
(d) both (a) and (b).

(viii) The process used for direct hydrogenation of coal is called
(a) Bergius process (b) Fischer-Tropsch process
(c) Koppers-Totzek process (d) Lurgi process.

(ix) 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.

(x) Which of the following type of collector is used for low temperature systems?
(a) flat plate collector
(b) line focussing parabolic collector
(c) paraboloid dish collector
(d) all of the above.

Group – B

2. (a) What do you mean by spontaneous combustion of coal? Explain how does it occur.

(b) State the conditions favourable to safe storage of bituminous coal with respect to size grading, size of pile, height of pile and site of storage.

(c) With a neat diagram state how low temperature carbonisation is done by Lurgi-Spiil gas process.

(1 + 1) + 4 + 6 = 12

3. (a) Describe how coal is carbonised in a Beehive Coke-oven. What are the demerits and merits of Beehive Coke-oven?

(b) With a flow diagram describe the by-product recovery process of a coke-oven plant.

(4 + 2) + 6 = 12

Group – C

4. (a) What are the advantages of fluidized bed catalytic cracking over fixed bed catalytic cracking?

(b) Why cloud point of a particular oil sample is always greater than its pour point?

(c) Explain the visbreaking and coking operation in a refinery.

5 + 3 + 4 = 12

5. (a) Why the diameter of atmospheric distillation column is uniform but the diameter of vacuum distillation column is not uniform?

(b) Explain the history of crude oil formation.

(c) Define aniline point and diesel index.

3 + 6 + 3 = 12

Group – D

6. (a) How does water gas differ from carbureted water gas?

(b) Explain the reaction zones in the fuel bed of a gas producer with a neat diagram.

(c) What is producer gas? Explain briefly the Winkler process.

2 + 5 + (2 + 3) = 12

7. (a) What is Coal Bed Methane? What are the environmental effects of coal bed methane extraction?

(b) What is solid retention time? Describe the effect of solid retention time on reduction of biodegradable solids by aerobic digestion.

7 + 5 = 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