भारतीय वन सेवा परीक्षा 2011
Indian Forest Services Examination

Sl. No. 681

D-VSF-L-URB

CHEMICAL ENGINEERING

Paper II

Time Allowed : Three Hours | *Maximum Marks : 200*

INSTRUCTIONS

Candidates should attempt question nos. 1 and 5 which are compulsory, and any ***THREE*** *of the remaining questions, selecting at least* ***ONE*** *question from each Section.*

All questions carry equal marks. Marks allotted to each part of a question are indicated against each.

Answers must be written in ***ENGLISH*** *only.*

Assume suitable data, if considered necessary, and indicate the same clearly. Symbols and notations have their usual meanings.

Neat sketches may be drawn, wherever required.

(Contd.)

Section 'A'

1. Answer any *four* of the following (maximum 150 words each) : 4×10=40

   (a) Write a note on Proximate and Ultimate analyses of coal.

   (b) Give significance of the terms 'fugacity', 'activity' and 'chemical potential'.

   (c) 'Entropy of the Universe is ever increasing'. Explain.

   (d) Explain the concepts of 'Activation Energy' and 'Frequency Factor' and significance of Arrhenius Equation.

   (e) Discuss the Advantages and Disadvantages of fixed-bed and fluidised-bed catalytic reactors.

2. (a) A fuel gas has the following composition by volume : 20

   CO_2 : 2%; CH_4 : 15%; H_2 : 40%; CO : 30% and N_2 : 13%.

   What is the composition of flue gases formed by burning this gas with 30% excess air ? Assume complete combustion to take place.

   (b) A gaseous mixture has the following composition *by weight* : 20

   CO_2 : 20%; CO : 10%; O_2 : 10%; CH_4 : 16%; C_2H_6 : 15% and N_2 : 29%.

   Express the composition of this gaseous mixture by mol% and vol%.

   (Atomic wts : C : 12; O : 16; H : 1; N : 14)

3. (a) What are the 'ideal reactors' ? What are the idealisations assumed for these reactors ? 15

(b) Derive a Performance Equation for an ideal plug-flow gaseous phase reactor. 15

(c) Give criteria for vapour-liquid equilibria. 10

4. (a) What is the difference between ideal gas law and van der Waal's Equation of State ? Elaborate your answer. 20

(b) Define Free Energy (G), Internal Energy (E), Enthalpy (H) and Total work function (A). Discuss the inter-relation of these energy properties and physical significance of the same. 20

Section 'B'

5. Answer any *four* of the following (maximum 150 words each) : 4×10=40

(a) List various raw materials that could be used for production of ethyl alcohol. Discuss chemistry of each of these processes.

(b) Explain cracking and reforming of petroleum fractions.

(c) What are the Green House gases ? Why they are called so ? How exactly they contribute to global warming ?

(d) What are the important techniques used to dispose off industrial solid wastes ? Discuss any two of them in details.

(e) Write a note on PERT/CPM charts and their utility.

6. (a) What are the various raw materials/feedstocks used in India to produce hydrogen required in the manufacture of ammonia ? Give merits and demerits of each of them. 20

(b) Explain how LDPE is manufactured. Give its flow sheet. Also compare its properties with that of HDPE. 20

7. (a) Discuss briefly the important Environmental legislations enacted in India covering Air, Water and Environment. 20

(b) Discuss briefly some important SPM (Suspended Particulate Matter) removal techniques used to treat gaseous effluents in the Chemical Industry. 20

8. (a) Define fixed capital and working capital. How do you estimate fixed and working capital requirements for a chemical process plant ? 20

(b) What is depreciation ? Give various methods of its calculation along with salient features of each of the method. 20