

B. Chemical Engineering 3rd Year 1ST Semester Examination, 2017

Energy Engineering

Time: Three Hours

Full Marks: 100

(50 marks for each part)

Use a separate Answer-Script for each part

Part I

Answer any three questions

All questions do not carry equal marks

Assume missing data, if any

1.(i) Briefly elucidate the processes involved in the conversion of lignocellulosic biomass to bioethanol/biobutanol with the help of a block diagram. Mention representative parametric values and catalyst(s)/microbes employed at different conversion steps. [6]

1.(ii) Briefly state the quality of feedstocks, types of reactions and pertinent process variables governing the yield of biodiesel. [6]

1.(iii). State the significance of viscosity Index, (Reid) vapour pressure and carbon residue of petroleum fuels. [6]

2.(i) Write 'short note' on the following:

(a) Multi-blade type wind machine for driving a reciprocating pump. (*Figure not required*)

(b) Fluid Flow patterns and corresponding temperature profiles in Recuperator (*Use figure*)

[4+4]

2. (ii) A gaseous fuel has the following composition: CH₄=34%; C₂H₆=30%; C₂H₄=16%; C₄H₈=10%; CO₂=5%; CO= 5%; O₂=3% and N₂=1%. Calculate the air/fuel ratio and the analysis of products of combustion using 50% excess air. [8]

3. (i) Briefly discuss the production of 'biogas' from biomass through anaerobic digestion mentioning typical reactions in each step and pertinent process conditions. [8]

3. (ii) Define " Stagnation Temperature" of a solar heater. Show with a typical calculation, the procedure of plotting the variation of τ_r , τ_a and τ with the angle of incidence for a flat plate type solar collector with two glass covers. Thickness of each cover: 6 mm; Refractive index of glass relative to air: 1.42; Extinction coefficient of glass 10 m^{-1} . [2+ 6]

4. (i) The following data (Table 1) have been obtained from the TBP experiment of a crude oil (specific gravity=0.801 at 15.6 °C):

Table 1

TBP range (°C)	C ₅ - 93	93-175	175-286	286-325	325-365	365-542	>542
Yield(V/V)%	3.90	11.09	24.00	20.00	13.25	22.00	5.14

Draw the TBP assay curve and determine TBP slope and 50% boiling point for the whole crude. Calculate the average boiling point and assess the base of the crude oil.

$$[K = \sqrt[3]{R} / (0.827\rho)] \quad [8]$$

4.(ii) Write a short note on 'Fischer-Tropsch process' for production of liquid fuel. [8]

BACHELOR OF CHEMICAL ENGINEERING EXAMINATION, 2017

(3rd Year, 1st Semester)

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Part II

Answer any five questions

5×10

1. Discuss in detail, the coal carbonization process (gas cleaning and tar distillation section not needed) to produce coke.
2. Discuss with the help of a neat flowsheet, the operation of gas processing plant to produce LPG from refinery gases.
3. With the help of a neat flowsheet, discuss the IGCC process.
4. With the help of a neat sketch discuss the principle of operation of heat pipe.
5. The United States Bureau of Land Management commented "*There are no economically viable ways yet known to extract and process oil shale for commercial purposes.*" Make your comment.
6. What are the advantages and disadvantages and constraints of Tidal Power Generation?