B. Tech. Sixth Semester (Fuel, P & P.O. & Petrochemical Technology) (OBS)

11048 : Petrochemical Technology-III (Special Technology-III) : 6 PC 04

P. Pages : 3
Time : Three Hours

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AW - 3263
Max. Marks : 80

Notes :
1. Due credit will be given to neatness and adequate dimensions.
2. Assume suitable data wherever necessary.
3. Diagrams and chemical equations should be given wherever necessary.
4. Illustrate your answer necessary with the help of neat sketches.
5. Discuss the reaction, mechanism wherever necessary.
6. Use of Refinery Engg. Charts and combustion charts permitted.
7. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION – A

1. Estimate the bubble point temperature and composition of vapour formed, of a fractional overhead at 130 psi pressure. The overhead has following composition. **13**

i) Propane = 05%
ii) i-butane = 85% &
iii) n-butane = 10%

OR

2. State the Rault's law and Dalton's law and derive an expression for equilibrium composition of vapour and liquid for the multicomponent system in term of total pressure (π), vapour pressure ($P_1^0, P_2^0, P_3^0, ...$) and feed composition ($F_1, F_2, F_3, ...$). **13**

3. a) Mention the basic information that is provided by the crude assay about crude oil. **2**

b) From which point of view characterization of crude oil is necessary? **3.**

c) The experimental ASTM data for a petroleum fraction is given below. Compute the EFV curve from this data by Edmister's method. **8**

% Distillate	IBP	10	30	50	70	90	FBP
Temp. °C	265	271	278	284	293	300	313

OR

4. a) Mention the various additive and non-additive properties of petroleum and petroleum fractions. **3**

b) What are the various types of distillations practiced in refinery engineering calculations? Mention their significances and compare them with all respect. **10**

5. The TBP distillation data at atmospheric pressure obtained for 35 OAPI gravity crude oil is reported as follow **14**

% Distillate	IBP	10	30	50	70	90	FBP
Temp. °C	75	185	280	350	415	490	550

successive flash vaporization is carried out for the above crude oil in the following manner:

i) I st flash – 40% material
ii) II[nd] flash – Remaining material

Compute the temperature required to vapourise 70% material by single and double flash vaporization.

OR

6. The ASTM distillation data for a gasoline fraction of 65 °API gravity is given below 14

% Distillate	IBP	10	30	50	70	90	100
Temp. °C	130	137	146	153	163	177	205

construct the phase diagram and calculate the temperature required to vaporize 70% material at 20kg/cm^2 pressure.

SECTION – B

7. a) On which test design of refinery distillation column tests on? 1

b) How degree of separation (fractionation) is measured? 3

c) How the design of fractionation system can be outlined? 4

d) Mention the typical operating data for vacuum distillation column. 5

OR

8. a) In vacuum distillation, on which factor amount of steam required depends on? 1

b) What are the main products of commercial interest that can be obtained from vacuum distillation? 2

c) Mention the ASTM gaps that are generally followed in practice in petroleum refineries. 4

d) State the significance of flash zone operating conditions. 6

9. Mention the important factors that affect the radiation from flames in tube still heaters. How these factors are related by Wilson, lobo and Hottel? 13

OR

10 A tube still heater is designed for a heat duty of 50,000.000 Btu/Hr. If the overall efficiency of tube still heater is 80% and fuel oil with net heating value of 17200 Btu/Ib is to be fired with 25% excess air (17.5 Ib/Ib fuel) with the air being preheated to 400 °F, steam is used for atomizing at a rate of 0.3Ib/Ib of fuel at 190°F The tube still heater tubes are of 5.0 inch O.D. 38.5 ft long and 10 inch spacing arranged in single row, and 1500ft^2 of projected area is available 13

i) H_{air} (400°F) = 82 Btu/Ib ii) H_{steam} (190°F) = 95 Btu/Ib
iii) $H_{flue\ gas}$ (1730°F) = 148 Btu/hr

Calculate :

i) Number of tubes required in radiant section.
ii) % Heat absorbed in convection section assuming wall losses of 5%
iii) The heat rate available per unit projected area

11. a) What affects the height and diameter of the stack? 1

b) Mention the factors responsible for failure of ignition of fuel in the oil fired burners. 4

c) What is the heating value of methane expressed as BTU per cubic ft? 4

d) Why excess air is required for combustion of fuels? Mention the excess air requirement of fuels when fired in pipe still heaters and boilers. 5

OR

12. a) What are the causes for long and spluttery flame when liquid fuels are fired in burners? 3

b) What do you understand by 3
i) Heating value
ii) Net heating value and
iii) Gross heating value

c) On which factors selection of products to be produced in the refinery depends on? 3

d) Compute the net heating value of fuel oil-5 in the data table. 5

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