# PRESIDENCY UNIVERSITY
## BENGALURU

**SET A**

## SCHOOL OF ENGINEERING
### END TERM EXAMINATION – MAY / JUNE  2024

**Semester :** Semester VI - 2021
**Course Code :** PET2011
**Course Name :** Oil and Gas Downstream Operations
**Program :** B.Tech.

**Date :** June 19, 2024
**Time :** 01.00pm to 04.00pm
**Max Marks :** 100
**Weightage :** 50%

**Instructions:**
*(i) Read all questions carefully and answer accordingly.*
*(ii) Question paper consists of 3 parts.*
*(iii) Scientific and non-programmable calculator are permitted.*
*(iv) Do not write any information on the question paper other than Roll Number.*

## PART A

### ANSWER ANY FIVE QUESTIONS                                 5QX2M=10M

1. Define the term "Complex hydrocarbons".

(CO1) [Knowledge]

2. State Octane number.

(CO2) [Knowledge]

3. Identify two derivatives of ethylene oxide.

(CO3) [Knowledge]

4. "Ethylene is sometimes known as the king of petrochemicals"- Describe the quoted statement.

(CO4) [Knowledge]

5. Define vacuum distillation unit.

(CO3) [Knowledge]

6. Identify three important properties of HDPE.

(CO4) [Knowledge]

7. List four significant uses of HDPE.

(CO4) [Knowledge]

## PART B

### ANSWER ANY FIVE QUESTIONS                                 5QX10M=50M

8. "Naphtha is a flammable liquid hydrocarbon mixture. Generally, it is a fraction of crude oil, but it can also be produced from natural gas condensates". Based on the quoted statement explain the production process of Naphtha from natural gas. Also discuss few uses of naphtha in daily life.

(CO1) [Comprehension]

9. Compare the advantages and disadvantages of ethane cracking and naphtha cracking for ethylene manufacture.

(CO2) [Comprehension]

10. Explain the concept behind the statement "all molecules spend the same amount of time inside a reactor" in the context of chemical conversion from Ammonia to Urea.

(CO2) [Comprehension]

11. "TAN is the key factor for determining a grade of a crude oil" Explain the quoted statement.

(CO3) [Comprehension]

12. Summarize and explain the key properties and uses of diesel in our daily life, including its chemical composition, energy content, density, and applications, to demonstrate a thorough understanding of its significance in modern society.

(CO3) [Comprehension]

13. Summarize and explain the key properties and uses of gasoline in our daily life, including its chemical composition, volatility, energy content, and applications, to demonstrate a thorough understanding of its significance in modern society.

(CO4) [Comprehension]

14.
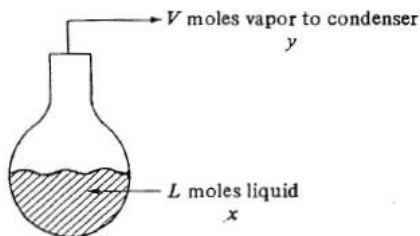


The above figure indicates a sample differential distillation unit, where L mol of crude contains L1 mol n-pentane and L2 mol n-hexane is distilled under differential conditions at 101.3 kPa until Y mol is distilled. Based on the above figure and statement determine average vapor mol fraction.

(CO4) [Comprehension]


## PART C

### ANSWER ANY TWO QUESTIONS                    2QX20M=40M

15. Hydrolysis of ethylene glycol was carried out in a batch reactor in the presence of Zeolite catalyst using a large excess of water. The following data was recorded:

| Time (min) | 0 | 30 | 60 | 90 | 120 | 150 | 180 |
|---|---|---|---|---|---|---|---|
| Concentration of ethylene glycol (CR) | 0.145 | 0.270 | 0.376 | 0.467 | 0.610 | 0.715 | 0.848 |

Determine the required time (t) to achieve 80% conversion of ethylene oxide if the initial concentration ethylene oxide $C_{A0}=3$mole/L. It is assumed that the reaction becomes first order.

(CO2) [Application]

16. A liquid phase reaction from crude oil to Diesel C→D is carried out in an installed batch reactor in a refinery. The initial concentration of crude oil is 1.0 kmol/L. The tabulated data is obtained are given table

| Time (sec) | 35 | 45 | 90 | 120 | 180 | 240 | 300 |
|---|---|---|---|---|---|---|---|
| The concentration of crude decreasing | 0.77 | 0.56 | 0.44 | 0.31 | 0.22 | 0.11 | 0.0096 |

Calculate the rate constant for the reaction. Also, calculate the required time for 85% conversion. Assume the reaction order is zero.

(CO2) [Application]

17. A mixture of 100 mol containing 50mol% gasoline and 50 mol % diesel is distilled until 40 mol is distilled. If the distilled liquid mol fraction is 0.277, calculate the average vapor mol fraction. Assume atmospheric pressure is 101.32 kPa.

(CO3) [Application]