BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: BE   SEMESTER: IV
BRANCH: CHEMICAL ENGINEERING   SESSION : SP/2019

SUBJECT : CL4003 PETROCHEMICALS AND REFINERY ENGINEERING

TIME: 1.5 HOURS   FULL MARKS: 25

INSTRUCTIONS:
1. The total marks of the questions are 30.
2. Candidates may attempt for all 30 marks.
3. In those cases where the marks obtained exceed 25 marks, the excess will be ignored.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. The missing data, if any, may be assumed suitably.

Q1 (a) Define the following terms: (a) Total proved reserves of crude oil, (b) Reserves-to-   [2]
         production (R/P) ratio.
    (b) What is crude oil? What are the different ways to express the composition of crude oil?   [3]

Q2 (a) A gas oil sample has the ASTM D 86 temperatures of 261.7, 270, 279.4, 289.4 and 307.2   [2]
         °C at 10, 30, 50, 70, and 90 vol% distilled. Calculate volume average boiling point (VABP)
         and mean average boiling point (MeABP) for this fraction.
    (b) What are the commonly used distillation methods for the evaluation of crude oil? Explain   [3]
         ASTM D86 and ASTM D1160 methods for evaluation of crude oil.

Q3 (a) What is the significance of flash point? Write the name of two different methods which   [2]
         are used for the determination of flash point of petroleum products.
    (b) A kerosene product with boiling range of 175-260 °C from Mexican crude oil has the API   [3]
         gravity of 43.6. (ASTM D86 10% temperature = 375 F). (a) Estimate its flash point. (b) For
         safety reasons it is required to have a flash point of 65 °C to be able to store it in a hot
         summer. How much n-tetradecane should be added to this kerosene for a safe storage?
         Flash point of n-tetradecane = 100 °C. Use the following correlations:
         $$T_{FP} = 0.69\, T_{10\%} - 118.2;\ (\,T_{FP}\ \text{and}\ T_{10\%}\ \text{are in F})$$
         $$\log_{10} BI_F = -6.1188 + \frac{2414}{T_{FP} - 42.6};\ (T_{FP}\ \text{is in K})$$
         where T_{FP} is flash point and BI_F is flash point blending index.

Q4 (a) Why is crude oil desalting an essential operation in the refinery? What are the different   [2]
         parameters which affect the efficiency of the electrostatic desalter?
    (b) Differentiate between physical separation processes and conversion processes. Draw the   [3]
         schematic of gas oil generations in refinery.

Q5 (a) What is the role of catalytic reforming unit in the refinery? Write the major reforming   [2]
         reactions.
    (b) Describe semi-regenerative fixed bed reforming process with neat process flow sheet.   [3]
         Plot composition profile of various hydrocarbons inside the reactors.

Q6 (a) What are the different classes of industrial thermal cracking processes? How are they   [2]
         different from each other?
    (b) Describe coil Visbreaking and soaker Visbreaking processes with neat process flow sheet.   [3]

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