BITS, PILANI, K. K. BIRLA GOA CAMPUS, FIRST SEMESTER 2022 – 2023
MID-SEM Test: Petroleum Refining Technology (CLOSED BOOK)
COURSE CODE: CHE F422
DATE: 02/11/2022 TIME: 2:00 PM – 3:30 PM MAX. MARKS: 60

Question 1 Answer the following [3 x 4 = 12 Marks]

a. Why is the feed (heavy hydrocarbons) to FCC unit needs to be pretreated?
b. How is heat management done in the main reactors of each of the following process?
   i. Fixed bed cracking process (Houdry's process)
   ii. Flexi coking process
c. Why is catalyst pore structure/size important in case of FCC operation? How is the pore size affect activity and regeneration efficiency of the catalyst?
d. What is the function of each of the following units?
   i. Cyclone separators in reactor section of FCC unit
   ii. Low pressure separator of Hydrocracker unit
   iii. Burner/Furnace in flexi coking unit

Question 2 Answer the following questions [4 x 5 = 20 Marks]

a. How is crude oil classified? What are the different methods used for deciding this classification? Explain the method which is based on API gravity.
b. Why are the following additives added in gasoline? Give one example of each one of them.
   i. Anti-icing agents
   ii. Inhibitors
c. Give the specific reason for each one of them
   i. Why is stream injected at the end of the reactor section in a FCC unit?
   ii. Why was kerosene preferred as a fuel for domestic needs in earlier days?
   iii. Why is diesel with diesel index lower than 45 not preferred to be used?
   iv. Why is top tray reflux arrangement of crude oil distillation tower is not preferred?
d. Write the specific answer for each one of the following
   i. The ultimate stable and end products of thermal cracking of heavy crude are _____ and _____
   ii. The thermally cracked products have relatively _____ (higher/lower) viscosity and _____ (higher/ lower) octane number than the feed.
   iii. Time required for the thermal cracking of heavier crude _____ (increases/decreases) with increase in API gravity of the feed.
   iv. The maximum CCR wt% that is allowed in the feed to FCC is _____.
e. What is the effect of each of the following parameters on the life of Hydrocracking catalyst?
   i. H_2/HC ratio ii. Reaction temperature iii. Feed rate iii. Reactor pressure

Question 3 Answer the following questions [5 x 3 = 15 Marks]

a. What are the important properties of Bitumen? What are its various applications? Which property is determined by using Ball and Ring test method? How is this test method carried out (Explain with focus on important points)?
b. Explain the "Regeneration" section process of a FCC unit in detail (main function, inlet/outlet streams, operating conditions, subsections and their functions, product specifications, challenges/issues).

c. With respect to Hydrocracking unit, answer the following
   i. What are the typical products from Hydrocracking unit (based on Indian market demand)? And what are its typical operating conditions (T and P)?
   ii. What are the reactions involved? Are these reactions endothermic or exothermic?
   iii. What kind of catalyst is used for this process? Explain the functions of the catalyst used.

Question 4 **[6 Marks]**

Draw a process flow diagram for a Soaker Visbreaking process. Explain the function of each the units/blocks of the process. Also mention all important operating conditions at various stages.

Question 5 **[7 Marks]**

In a refinery side stream operation, the fraction to be separated and collected is kerosene. The mixture entering the side stripper is 6000 bbls/hr. The 50% point of the kerosene is 148^{o}C. The mixture also contains straight run naphtha, which has the mid boiling point as 73^{o}C. If the ASTM Gap is 17 and amount if the number of plates used in a side stripper are 15 then find the amount of kerosene distilled from this side stripper.