PETROLEUM REFINERY ENGINEERING
(CHEN 4132)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) With increase in the number of carbon and hydrogen atoms in hydrocarbon molecules, the density of petroleum products
(a) decreases (b) increases
(c) remain same (d) unpredictable from the data.

(ii) Which is the most ideal feed stock for 'coking' process used for the manufacture of petroleum coke?
(a) Naphtha (b) Vacuum residue
(c) Light gas oil (d) Diesel.

(iii) Feedstock for the production of biodiesel is
(a) herbal plants (b) used vegetable oils
(c) LSHS (d) bagasse.

(iv) In catalytic cracking, the
(a) gasoline obtained has a very low octane number
(b) pressure & temperature is very high
(c) gasoline obtained has very high aromatic content
(d) gasoline obtained has very high amount of gum forming compounds.

(v) The first crude oil refinery of India is located at
(a) Naharkatiya (b) Digboi (c) Kochi (d) Madras.

(vi) Flash point of a liquid petroleum fuel gives an idea about its
(a) volatility (b) explosion hazards characteristics
(c) nature of boiling point diagram (d) all (a), (b) and (c).

(vii) Carbon percentage (by weight) in crude petroleum may be about
(a) 65 (b) 75 (c) 85 (d) 95.

(viii) Vacuum maintained in the vacuum distillation tower of the crude distillation plant is about _____ mm Hg (absolute).
(a) 5-10 (b) 30-80 (c) 150-250 (d) 350-400

(ix) The feedstock for alkylation are olefins and _____
(a) n-heptane (b) isobutene (c) Propane (d) isopentane.

(x) A solvent for aromatics removal in LOBS production is
(a) Propane (b) Furfural (c) Toluene (d) Ethanolamine.

Group- B

2. (a) Discuss the various theories related to the origin of petroleum. [(CO1, CO2)(Apply/IOCQ)]
(b) List and explain the classification of petroleum crude. [(CO2)(Understand/LOCQ)]
(c) Define dewaxing and diesel index. [(CO1,CO2)(Remember/LOCQ)]
4 + 4 + 4 = 12

3. (a) Discuss the different petroleum fractions obtained during distillation of crude petroleum indicating their boiling ranges. [(CO1)(CO2)(Remember/LOCQ)]
(b) What is the purpose of VDU and ADU operation. [(CO1, CO2)(Apply/IOCQ)]
(c) Name two petroleum products along with their applications. [(CO2)(Understand/LOCQ)]
6 + 4 + 2 = 12

Group - C

4. (a) Differentiate between thermal cracking and Vis-breaking. [(CO2)(Remember/LOCQ)]
(b) Write a short note on gasoline blending. [(CO2)(Apply/IOCQ)]
(c) Describe the FCC process in refinery. [(CO2)(Understand/LOCQ)]
4 + 4 + 4 = 12

5. (a) What is reforming? Explain in detail catalytic reforming. [(CO2)(Understand/LOCQ)]
(b) Discuss the Alkylation refining processes. [(CO2)(Analyze/IOCQ)]
(c) State the causes of removing asphalt from petroleum product. [(CO2, CO3)(Understand/LOCQ)]
(1 + 4) + 5 + 2 = 12

Group – D

6. (a) What is the full name of MEK? What is your best practice for determining the maximum allowable temperature rise in hydrotreating beds? What solutions is used for managing temperature rise? [(CO2)(Understand/LOCQ)]
(b) Describe the process of hydrotreating. [(CO2,CO3)(Analyze/IOCQ)]
(1 + 2 + 2) + 7 = 12

7. (a) Among molecular sieves and Pt, which one is more suitable for isomerisation of a feed in which there is a lot of moisture? Why? [(CO4)(Evaluate/HOCQ)]
(b) Why is recycling of unconverted reactant necessary in isomerisation? [(CO4)(Analyze/IOCQ)]

(c) What is the negative impact of the hydrogen atmosphere maintained in the Isomerization reactor? [(CO4)(Analyze/IOCQ)]

4 + 4 + 4 = 12

Group – E

8. (a) What is the utility of catalytic iso-dewaxing? [(CO4)(Analyze/IOCQ)]
   (b) Why are aromatics removal and hydrofinishing necessary for production of LOBS? [(CO4)(Analyze/IOCQ)]
   (c) What are the important characteristic properties of LOBS? [(CO4)(Remember/LOCQ)]

4 + 4 + 4 = 12

9. (a) Discuss the motive behind refinery-petrochemicals integration. [(CO3)(CO4)(Analyze/IOCQ)]
   (b) Why is hydrogen considered a very good source of energy? [(CO3)(Analyze/IOCQ)]

8 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	41.67	54.16	4.17

Course Outcomes (CO):

At the end of the course the students should be able to:
1. Understand the oil refining process.
2. Categorize associated downstream processing technologies, operations and economics.
3. Grasp the principles for improving refinery economics.
4. Develop the essential knowledge and skills required to work as an engineer in the oil, gas and petrochemical sectors.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question