Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (CHE)/SEM-7/CHE-704B/2011-12

2011

PETROLEUM REFINERY ENGINEERING

Time Allotted : 3 Hours *Full Marks :* 70

The figures in the margin indicate full marks.

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

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) Average boiling point used for determining the characterization factor is

      a) volume average boiling point

      b) molal average boiling point

      c) cubic average boiling point

      d) none of these.

   ii) Good quality kerosene should have

      a) low smoke point

      b) high smoke point

      c) high aromatics content

      d) low paraffin content.

iii) The diesel index is defined by

a) $(°\text{API}) \times (\text{Aniline point}, °\text{F})/100$

b) $(°\text{API}) \times (\text{Aniline point}, °\text{C})/100$

c) $(°\text{API}) \times 100/(\text{Aniline point}, °\text{F})$

d) $(°\text{API}) \times 100/(\text{Aniline point}, °\text{C})$.

iv) LPG is a mixture of

a) Pentane & Ethane

b) Propane & Butane

c) Ethane & Methane

d) Hexane & Butane.

v) Viscosity index is an important parameter for which fraction of the petroleum crude ?

a) Gasoline b) Kerosene

c) Diesel d) Lube Oil.

vi) Which is the most ideal feedstock for 'coking' process for the manufacture of petroleum coke ?

a) Naphtha b) Diesel

c) Light gas oil d) Vacuum residue.

vii) If 10% boiling point in the ASTM distillation is low, then

a) vapour loss is negligible

b) vapour loss is high

c) flash point is high

d) all of these.

viii) The most commonly used solvent for dewaxing in a refinery is

a) MEK b) Naphtha

c) Sodium plumbite d) Petroleum ether.

ix) What is the catalyst of polymerization in a refinery ?

a) Phosphoric acid of kieselghur

b) Aluminum chloride

c) Nickel

d) Vanadium pentoxide.

x) Reid vapour pressure of gasoline is the measure of

a) Knocking tendency

b) Flash point

c) Vapour locking tendency

d) Pour point.

xi) Diesel should have

a) low smoke point

b) high Aniline point

c) high aromatic content

d) low paraffin content.

xii) Aromatics present in kerosene may be removed by

a) Methyl ethyl ketone

b) Furfural

c) Monoethanol amine

d) Liquid hexane.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. 40% of a LSR gasoline (35° API), 30% of polymer gasoline (40° API) and 30% of alkylated gasoline (30° API) are blended. What is the °API of the blend ? Calculate also the characterization factor of this blend has 140, 170, 210, 245, 280, 310, 350 & 370 °F as 10, 20, 30, 40, 50, 60, 70 & 80% Boiling point.

   Given : *sp. gr.* of the blend : 0·785 2 + 3

3. What is the importance of ASTM distillation ? Discuss the experimental procedure. 2 + 3

4. a) Why 'reboilers' are not used in crude distillation unit ?

   b) Briefly describe different reflux arrangement used in the atmospheric distillation unit of a petroleum refinery. 1 + 4

5. What do you mean by 'TBP overlap' and 'ASTM gap'. Explain your answer graphically. 2 + 3

6. What is 'Visbreaking' operation ? Briefly explain the effects of different operating variables on the yield of products.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) What type of impurities are present in crude oil ?

b) Explain the method of desalting of crude oil with a neat sketch of single electrical desalting process.

c) Explain the hydrocarbon present in crude and the percentage of elemental composition.

d) A lube oil consists of 4 fractions *A*, *B*, *C* and *D*. Their molar compositions and vapour pressure are given below :

Constituents	Mole %	Pure component vapour pressure in mm Hg
A	10	700
B	20	720
C	30	740
D	40	750
	Total = 100	

8. a) What is polymer gasoline ?

   b) What are the feedstock and common catalyst used for production of polymer gasoline ?

   c) Using a process flow diagram, describe the production of polymer gasoline mentioning all the operating conditions employed. 2 + 4 + 9

9. a) Why is hydro treatment necessary in petroleum refinery ? 2

   b) What are different impurities present ? Show the chemical reactions involved in the hydrotreatment of a petroleum feedstock consisting of S, N, O and Cl bearing impurities. 4

   c) Using a process flow diagram, describe the hydrotreatment operation, mentioning influence of different operating parameters and catalyst employed. 9

10. a) "Catalytic Cracking is preferred to Thermal Cracking", explain.

    b) What is feedstock for catalytic cracking process ?

c) What are the properties changed due to cracking of higher molecular weight hydrocarbon ?

d) With a neat sketch describe the process of fluid catalytic cracking of process. 4 + 1 + 2 + 8

11. Write short notes on any *three* of the following : 3 × 5

a) Biodiesel

b) Alkylatioin operation for production of *i*-octane

c) Merox sweetening process

d) Reactions pertaining to catalytic reforming operation of HSR naptha.