UNIVERSITY OF
KWAZULU-NATAL
INYUVESI
YAKWAZULU-NATALI

SCHOOL OF ENGINEERING

MAIN EXAMINATIONS: NOVEMBER 2019

COURSE AND CODE: PETROLUEM & SYNTHETIC FUEL PROCESSING
ENCH4PP

DURATION: 2 HOURS

TOTAL MARKS: 100

INTERNAL EXAMINERS: PROF AH MOHAMMADI

INTERNAL MODERATOR: PROF D RAMJUGERNATH

EXTERNAL MODERATOR: DR M CHETTY

INSTRUCTIONS:

1. **ALL** questions should be attempted.
2. Any programmable or non-programmable calculator may be used provided it has been cleared of any information that would subvert the purpose of the examination.
3. Calculations must be shown in sufficient detail to illustrate your understanding of the procedure.

QUESTION 1

a) Which exploration method for oil and gas is most commonly used in the petroleum industry? Briefly explain the method.

(4)

b) List and explain the three main Enhanced Oil Recovery (EOR) methods which are used for oil production from reservoirs.

(6)

TOTAL /10/

QUESTION 2

a) Sketch a typical block diagram for a natural gas refinery showing the three main processing units (Mention the feed, typical products and typical solvents).

(8)

b) Which units are used in both natural gas processing and crude oil refining?

(2)

TOTAL /10/

QUESTION 3

a) Compare an Alkylation unit and a Polymerisation unit in terms of their functions, typical feed(s), typical catalyst(s) and typical products (main product(s) and by-products).

(10)

b) Compare Catalytic Cracking units in terms of their functions, typical feed(s), typical catalyst(s) and typical products (main product(s) and by-products).

(10)

TOTAL /20/

QUESTION 4

a) Sketch typical block diagrams of extraction and conversion processes for production of lubricant oils in a crude oil refinery.

(8)

b) Explain which process yields higher quality product and why?

(2)

TOTAL /10/

QUESTION 5

a) Explain why the sulphur content of synthetic fuels is negligible in comparison with the sulphur content of petroleum based fuels?

(3)

b) In a crude oil refinery, which unit is used to remove light mercaptan species using a solvent? Sketch a typical block diagram of this unit and show its typical feed(s), typical product(s) and typical solvent.

(7)

TOTAL /10/

QUESTION 6

a) List the typical reactions that occur in a methanol to gasoline (MTG) conversion process which produces hydrogen gas?

(2)

b) Explain whether methanol which is produced in the MTG process can be used for blending with other products?

(2)

c) List a point with regard to the function, typical feed(s), typical product(s), and typical catalyst(s) for a Fischer Tropsch (FT) process.

(4)

d) Explain which catalyst is not preferable for the FT process and why.

(2)

TOTAL /10/

QUESTION 7

a) What are the main products of a coal pyrolysis process?

(3)

b) Explain what the main limitations/disadvantages of using a coal pyrolysis process is.

(7)

TOTAL /10/

QUESTION 8

Estimate the Reid Vapour Pressure (RVP) of a blend of Pyrolysis gasoline (Pygas), Reformate, Alkylate and FCC gasoline. Properties and available quantities of the gasoline fractions are given in the table below:

Gasoline Fraction	Quantity/Volume (Barrel per day)	RVP (psi)
Pygas	6000	7.23
Reformate	5000	3.20
Alkylate	4000	5.42
FCC Gasoline	3000	6.75

Considering:

$BI_{RVPi} = RVP_i^{1.25}$ and $BI_{RVP,Blend} = \Sigma X_{vi} \times BI_{RVPi}$

BI_{RVPi} : RVP blending index for gasoline fraction i
RVP_i : Reid Vapour Pressure (psi) for gasoline fraction i
X_{vi} : volume fraction of gasoline fraction i

TOTAL /20/