INTERNATIONAL UNIVERSITY OF EAST AFRICA
'Learning to Succeed'

FACULTY OF ENGINEERING

END OF SEMESTER EXAMINATIONS - APRIL 2025

PROGRAMME: BACHELOR OF PETROLEUM ENGINEERING

YEAR/SEM: YEAR 4/SEMESTER 2

COURSE CODE: PTE4221

NAME: NATURAL GAS ENGINEERING

DATE: 2025-04-24

TIME: 2:00-5:00PM

INSTRUCTIONS TO CANDIDATES:

1. Read the instructions very carefully
2. The time allowed for this examination is STRICTLY three hours
3. Read each question carefully before you attempt and allocate your time equally between all the Sections
4. Write clearly and legibly. Illegible handwriting cannot be marked
5. Number the questions you have attempted
6. Use of appropriate workplace examples to illustrate your answers will earn you bonus marks
7. Any examination malpractice detected will lead to automatic disqualification.

DO NOT WRITE ANYTHING ON THE QUESTION PAPER

Section A Answer three (3) Question in A

Question 1:

(a) What is a Gas reservoir? Give the two classifications of Reservoirs by regulatory agency

(b) Estimate gas in place in a reservoir with an areal extent of 2550 acres, average thickness of 50 ft, average porosity of 20%, connate water saturation of 20%, reservoir temperature of 186^{o}F, initial reservoir pressure of 2651 psia, and reservoir gas deviation factor of 0.880 at 186^{o}F and 2651 psia

(20Marks).?

Question 2:

(a) Differentiate the following;

i. Crude Oil and Natural Gas

ii. Associated Gas and Dissolved Gas

iii. Non-associated Gas and Natural Gas Liquids

(b) Calculate the viscosity of the gas mixture given below at 200^{o}F and a pressure of one atmosphere absolute.

Component	Mol.Fraction	Mol. Weight	Viscosity
C1	0.85	16.04	0.020
C2	0.09	30.07	0.012
C3	0.04	44.09	0.0098
n-C4	0.02	58.12	0.0091

(20 Marks)

Question 3:

(a) What do you understand by “phase diagram”
(b) Sketch the temperature pressure diagram for pure substance
(c) Define all the critical properties for the above system 20 Marks

Question 4:

(a) Describe the factors that are important to the physical behavior of hydrocarbon molecules
(b) Draw and describe a phase diagram for a Critical Point of 2-Component Mixture
(c) Describe the three generally recognized reserves categories used to reflect degrees of uncertainty in the reserve estimate

(20 Marks)

Section B Answer two (2) questions in B

Question 1:

?1) Calculate the initial gas reserve of a 160 acre unit of the Bell Gas Field by volumetric depletion and under partial and complete water drive. Given:

i. Average porosity = 22 %

ii. Connate water saturation = 23 %

iii. Residual gas saturation after water displacement = 34 %

iv. Bgi = 188.0 SCF/cu ft at Pi = 3250 psia

v. Bg = 150.0 SCF/cu ft at 2500 psia

vi. Bg = 27.6 SCF/cu ft at 500 psia

vii. Area = 160 acres

viii. Net production thickness = 40 ft

20 marks

Question 2:

Describe the classification of Natural Gases according to the following

i. Reservoirs

ii. Composition

iii. H_2S

iv. CO_2

v. Volumes

(20 Marks)

Question 3:

?(a) Why is the measurement of gas glow a necessity?
(b) Write a brief description, accuracy, range, advantages and disadvantages of any two pressure differential meters that you know (20 marks)

Question 4:

a) Using the temperature pressure diagrams, discuss the behavior of the following: Dry Gasses, Wet Gases and retrograde Gases
(b) Briefly explain what you understand by volatile oils (20 marks)