



KENYATTA UNIVERSITY
EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN PETROLEUM
ENGINEERING

EPL 512: OIL RECOVERY MECHANISMS

1ST SEMESTER 2023/2024

TIME: 2 Hours

INSTRUCTIONS:

The examination consist of **TWO** sections (**A and B**). Answer **SECTION A (COMPULSORY)** and **ANY TWO QUESTIONS** from **SECTION B**.

Section A- Compulsory (30 marks)

QUESTION 1

An oil reservoir had an initial pressure of 4200psi and formation volume facto of 1.25rbbl/stb. The reservoir area is 300acres with 32ft pay thickness. Oil was produced from the reservoir until the reservoir pressure became 3750psi and oil formation volume factors became 1.45rbbl/stb and gas saturation of 10%. The reservoir is not known to have an active aquifer or an expanding gas cap. The main energy for fluid movement is solution gas drive. Other pertinent information about the reservoir system is: reservoir porosity = 22%, water saturation = 30%.

After secondary recovery(pressure maintenance), 50,000stb was left. After waterflooding, only 6,000stb was left.

- (i) What is the oil initially in place? (3 marks)
- (ii) What is the recovery factor of the primary recovery mechanism for this reservoir? (3 marks)
- (iii) How much oil is left after primary recovery? (3 marks)
- (iv) What is the recovery factor of the pressure maintenance job? (3 marks)
- (v) What is the recovery factor of the waterflood? (2 marks)
- (vi) How much oil was recovered through the waterflood? (2 marks)
- (vii) What are TWO possible factors responsible for performance of the waterflooding? (2 marks)
- (viii) What factors would motivate you to recovering the remaining oil? (3 marks)

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- (ix) State TWO reasons why so much of the oil could be recovered by pressure maintenance. (2 marks)
- (x) List the factors that affect enhanced oil recovery process by chemical injection. (3 marks)
- (xi) Suggest TWO possible reasons why waterflooding could not recover more oil than it did. (2 marks)
- (xii) Recommend TWO ways of enhancing primary recovery from the reservoir. (2 marks)

Section B- Answer any Two Questions (Each question 20 marks each)

QUESTION 2

- (a) Draw the following flood patterns:
 - (i) Normal seven spot pattern (4 marks)
 - (ii) Inverted four spot pattern (4 marks)
- (b) What are the benefits of a normal pattern over inverted pattern? (4 marks)
- (c) What are the screening guides for carbondioxide candidacy? (4 marks)
- (d) Suggest Two ways to improve primary recovery mechanisms. (4 marks)

SECTION 3

Discuss briefly the operating mechanisms of the following enhanced oil recovery processes:

- (i) primary recovery (4 marks)
- (ii) water injection (4 marks)
- (iii) miscible displacement (4 marks)
- (iv) immiscible displacement (4 marks)
- (v) waterflooding (4 marks)

QUESTION 4

- (a) In anticipating primary recovery, mark the region for the following fluids in a multiphase retrograde reservoir:
 - (i) dry gas (4 marks)
 - (ii) pure oil (4 marks)
 - (iii) retrograde oil (4 marks)
 - (iv) black oil (4 marks)
- (b) State the important screening guide for application of in-situ combustion. (4 marks)