JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

UNIVERSITY EXAMIMATION FOR THE DEGREE IN SCIENCE IN RENEWABLE ENERGY TECHNOLOGY AND MANAGEMENT

3RD YEAR 2ND SEMESTER 2023/2024 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: TEB 1302

COURSE TITLE: PETROLEUM TECHNOLOGY

EXAM VENUE: **STREAM: BSc. REN ENGY TEC & MGT**

DATE: /04/2024   **EXAM SESSION:**

DURATION: 2 HOURS

Instructions

1. **Answer question 1 (Compulsory) and ANY other two questions**

2. **Candidates are advised not to write on question paper**

3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

QUESTION ONE (COMPULSORY) (30 Marks)

    a. Define the following terms:
        i.   Petroleum (1 Mark)
        ii.   Reservoir (1 Mark)
    b. Distinguish the terms dead oil and live oil as used in petroleum technology. (1 Mark)
    c. Examine properties of water as analyzed in geologic formations. (2 Marks)
    d. A 18 psia pressure drawdown is required to produce 468 STBO/day. Use well PI to estimate the oil production rate at 8.5 psia pressure drawdown. (2 Marks)
    e. Compare and contrast two primary types of traps. (4 Marks).
    f. An oil reservoir has an average porosity = 0.315 in an area of 4860 acres with a net thickness of 102 ft, initial oil saturation of 72%, and initial oil formation volume factor of 1.245 RB/STB. Use the volumetric OIP equation to estimate OOIP. (2 Marks)
    g. Examine the five stages considered during the drilling process. (10 Marks).
    h. Examine the term well completion as used in petroleum technology. (4 Marks)
    i. Examine the terms upstream, midstream and downstream as used in petroleum industry. (3 Marks)

QUESTION TWO (20 Marks)

    a. Compare and contrast Measurement While Drilling (MWD) and Logging While Drilling (LWD). (4 Marks)
    b. Examine the various components of a rotary rig as used in drilling a well to access reservoir fluids. (12 Marks)
    c. The specific gravity of an oil sample is 0.815. Calculate the API density. (2 Marks)
    d. A well produces 400 MSCF gas per day and 300 STB oil per day. Calculate the GOR in MSCFG/STBO. (2 Marks)

QUESTION THREE (20 Marks)

    a. Examine the term well logging as used in petroleum technology. (3 Marks)
    b. Using the following correlations for dead oil and live oil provided below, compute the dead oil viscosity and live oil viscosity for a 41°API oil at 205 °F with 286 SCF/STB of dissolved gases. (6 Marks)

Dead oil: $\log_{10}\left(\mu_{oD}+1\right)=73.3\dfrac{10^{-0.0251\times°API}}{T^{0.564}}$

Live oil: $\mu_o = A\mu_{oD}^B$, where A = $10.7(R_s + 100)^{-0.515}$; B = $5.44(R_s + 150)^{-0.338}$

    c. Compute the Formation Volume Factor (FVF) of an oil sample that occupies 0.95 bbl at stock tank (surface) conditions and 1.25 bbl at reservoir conditions. (3 Marks)
    d. Examine the lifecycle of a reservoir (Use illustrations where appropriate). (8 Marks)

QUESTION FOUR (20 Marks)

a. Compare and contrast the different types of wells. exploration wells. (4 Marks)

b. Torsion in a drill string is caused by a twisting moment (or rotary torque T). Calculate the angle of twist (in degrees) for a 6.234 m length of pipe subjected to a rotary torque=4650 N.m. The shear modulus of elasticity is 58 GPa, and the polar moment of inertia of the drill string is 0.95×10^{-5} m^4. (2 Marks)

c. Calculate volumetric sweep efficiency E_{vol} and recovery efficiency (RE) from the following data: (10 Marks)

S_{oi}	0.68
S_{oa}	0.25
Area swept	450 acres
Total area	876 acres
Thickness swept	9.3 ft
Total thickness	14.2 ft
Neglect FVF effects since $B_{oi}{\approx}B_{oa}$	

d. Examine primary, secondary and tertiary production stages as used in petroleum technology. (4 Marks)

QUESTION FIVE (20 Marks)

a. A well is draining a gas-water reservoir. The drainage area of the well is 140 acres and has a net thickness of 16 ft. Initial properties are 15% porosity, 63% gas saturation and gas FVF of 0.0023 RB/SCF. What was the original gas in place in the drainage? (4 Marks)

b. Examine the term petroleum geology in terms of geologic history of the earth, rocks and formations, and finally sedimentary basins. (12 Marks)

c. Compare and contrast two major sources of sampling fluid data in a reservoir. (4 Marks).