



UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

SECOND SEMESTER EXAMINATIONS, MAY 2018

COURSE NO: PE 376

COURSE NAME: PETROLEUM OPERATIONS OF PROBLEM WELLS

CLASS: PE III

TIME: 3 HRS

Name: _____ Index Number: _____

*Begin each question from a fresh page. Number and space out sub-questions accordingly.
Clearly written and neatly presented answers are encouraged.*

ANSWER QUESTION ONE (1) AND ANY OTHER TWO (2) QUESTIONS (60 Marks)

QUESTION 1

- a. Predict the formation breakdown pressure for a hydraulic fracturing operation due to take place in an almost 85 % sandstone formation at a depth of 8000 ft. The formation whose Poisson's ratio of is 0.25 also has a Biot's poro-elastic constant of 0.72. The average density of the overburden formation is 165 lb. /ft³. The pore pressure gradient in the sandstones is 0.385 psi/ft. If a tectonic stress of 1800 psi and a tensile strength of the sandstone formation is 990 psi, from a systematic approach, calculate the breakdown pressure for the sandstone formation. (7)
- b. Mention 4 acidizing additives and give the specific function in the operation (6)
- c. Mention five (4) wellbore problems that can result in low productivity. (4)
- d. Give three primary requirements of an acid (3)

QUESTION 2

- a. A gas reservoir has a permeability of 2 md. A vertical well of 0.328-ft radius draws the reservoir from the center of an area of 115 acres. If the well is hydraulically fractured to create a 2,000-ft long, 0.12-in. wide fracture of 150,000md permeability around the center

- of the drainage area, what would be the fold of increase in well productivity? As a Petroleum Engineer, what is the impact of this value? (5)
- b. Explain briefly 3 impacts of sand production problems in an oil well (6)
 - c. Give 3 major causes of sand production (6)
 - d. Most fracturing fluids fall into 3 distinct categories, list them (3)

QUESTION 3

- a. Explain concisely hydraulic fracturing as oil and gas well productivity enhancement operation. (5)
- b. Explain matrix acidizing as a well stimulation operation and state the type of acids used for (i) Sandstone formation and (ii) Carbonate formation (5)
- c. Mention 3 situations/areas where hydraulic fracturing operation is beneficial (3)
- d. The productivity of fractured wells depends on two steps or two potentials mention and explain briefly what they involve. (4)
- e. Explain briefly acid washing and fracture acidizing (3)

QUESTION 4

- a. Mention five properties of resins (5)
- b. Tubing Plugging can be caused by several factors (Paraffin and/or asphaltene plugging, Residual cement plugging and Iron scales). In a table form, provide the causes of these factors, their preventive mechanisms as well as the removal methods if they occur. (9)
- c. Explain liquid loading as production problem in the oil and gas industry (3)
- d. What is formation damage? Give the significance of formation damage (3)

Equations and Graphs to use

$$s_d = \left(\frac{k}{k_d} - 1 \right) \ln \left(\frac{r_d}{r_w} \right)$$

$$\frac{J_d}{J_o} = \frac{\frac{k_d}{k} \ln \left(\frac{r_e}{r_w} \right)}{\frac{k_d}{k} \ln \left(\frac{r_e}{r_w} \right) + \ln \left(\frac{r_d}{r_w} \right)}$$

$$\sigma_v = \frac{\rho H}{144}$$

$$\sigma'_h = \frac{v}{1-v} \sigma'_v, \quad \sigma'_v = \sigma_v - \alpha P_p \quad P_p = P_{pg} \times H, \quad P_{bd} = 3\sigma_{h,min} - \sigma_{h,max} + T_0 - P_p$$

$$\sigma_{h,max} = \sigma_{h,min} + \sigma_{tect}$$

$$\sigma_{h,min} = \sigma'_h + \alpha P_p$$

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