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**Presidency University**

**Bengaluru**

**SCHOOL OF ENGINEERING**

**MAKE-UP EXAMINATION – SEP 2023**

**Date**: 03.10.2023

**Time**: 09.30 AM to 12.30 PM

**Max Marks**: 100

**Weightage**: 50%

**Course Code**: PET 228

**Course Name**: Workover and Stimulation

**Program & Sem**: B.Tech (PET) & VI Sem

**Instructions:**

1. *Read the all questions carefully and answer accordingly.*
2. *Question paper consist of three parts, PART A, B & C*
3. *All questions are mandatory*

**Part A [Memory Recall Questions]**

**Answer the Question. Each question carries THIRTY marks. (1Qx 30M= 30M)**

1. Answer the following question *[Each question carry 3 marks]*

I. Match the following

|  |  |
| --- | --- |
| A. Open Hole Completion | 1. Effectively well bore diameter and productivity may be reduced |
| B. Cased Hole Completion | 2. Permits multiple completions |
|  | 3. Full hole diameter is available to flow |
|  | 4. Difficult to selectively stimulate producing interval |
|  | 5. Log interpretation sometimes critical in order not to miss commercial sand, yet avoid perforating sub marginal zones |
|  | 6. Adaptable to special drilling techniques to minimize formation damage or to prevent lost circulation into the producing zone |

II. The statements are incorrect. Write the correct statements

*(a) Flanged type Xmas trees are used in HPHT wells*

*(b) Routine maintenance includes straightening of collapsed casing*

*(c) First application of Coil Tubing is in Hydro fracturing*

III. What is Liner completion? Write any two advantage of Liner completion.

IV. Why the combination of HF and HCl is called MUD ACID? Give two example of Organic Acid.

V. Write three characteristics of Coil Tubing Reel.

VI. What are three selection criteria for Fracture model?

VII. The purpose of sandstone acidizing is to \_\_\_\_\_\_\_\_to the sandstone near the wellbore that occurred during drilling and well completion processes. For sandstones, the typical treatments usually consist of a mixture of 3 wt% \_\_\_\_\_ and 12 wt% \_\_\_\_\_\_\_, preceded by a 15 wt% \_\_\_\_ preflush.

|  |  |
| --- | --- |
| VIII. Identify 1, 2 & 3 from the diagram. |  |

IX. Statement: The advisable to have a preflux of HCl while acidizing a clastic sandstone

Assumption I: HCl preflush is to remove all carbonates in a region

Assumption II: HF with can produce CaF2 which is precipitated

Assumption III: Typically, the volume of the preflush is half that of the mud acid flush

(i) Only Assumption I follows

(ii) Both Assumptions I & III follow

(iii) Both Assumptions I & II follow

(iv) Assumption I, II & III follow

(v) Only Assumption II follows

(vi) None of the Above

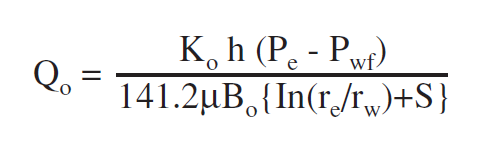
X. Write any one function of the following subsurface equipments (a) Sliding Side Door (b) Side Pocket Mandrel (c) Expansion Joint (C.O.No. 1, 2, 3, 4) [Knowledge]

**Part B [Thought Provoking Questions]**

**Answer all the Questions. Each question carries TEN marks. (4Qx10M=40M)**

2. Contribution of Hydro fracturing and Matrix acidization in the flow rate improvement for a damage formation can be explain with the help of the following radial flow equation. Discuss how?

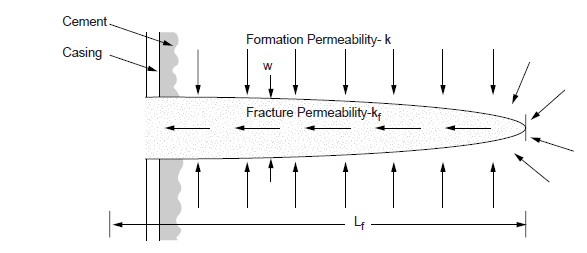
(C.O.No. 2) [Comprehension]



3. Do as directed, (C.O.No. 3) [Comprehension]

(i) “*TAML 3 and TAML 4 are two complicated type of well completion*”-Write any two difference between these two.

(ii) With the help of below mention diagram discuss how Fracture conductivity can be improved



(iii) “*Tubing less completion is a completion design in which the reservoir fluids are produced through small-diameter casing*”- Mention any two disadvantage of Tubing less cased hole completion.

(iv) “*Sometimes we use perforated liner completion in a well*”-List out two conditions for selecting perforated liner completion.

(v) Truck Mounted Rigs, Modular Rigs, Jack Up Rigs, Floaters Rigs, Anchor Moored Rigs, Dynamic positioning Vessels, Semisubmersibles Rigs-We have option selecting any of these loads based on some criteria’s. Write any two of those criteria.

4. Discuss how will you complete a Directional HPHT well (L-profile) with multiple consolidated payzone. It is expected to have sour heavy crude oil and well will deplete in a short span of time so provision for primary recovery should be kept. (C.O.No. 1) [Comprehension]

5. “*The reaction of the formation rock / in situ (formation/injected) fluids with an incorrectly chosen stimulation fluid may generate further formation damage/ impairment*”-Discuss with five relevant points.

(C.O.No. 4) [Comprehension]

**Part C [Problem Solving Questions]**

**Answer all the Questions. Each question carries THIRY marks. (1Qx30M=30M)**

6. The multizonal producing well is located at some XYZ location. The pay zones are identified as below

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Depth (ft.)** | **Formation** | **When Depleted (from the day of completion)** | **Poison ratio** | **Poro-elastic constant** | **Pore Pressure Gradient (Psi/ft.)** | **Porosity** | **Permeability** |
| 3500 to 5500 | Sandstone | 1 year | 0.18 | 0.72 | 0.25 | 20% | 50 mD |
| 6000 to 7000 | Carbonate | 1.5 year | 0.22 | 0.72 | 0.28 | 15% | 36 mD |
| 8500 to 10000 | Shale | 3 year | 0.45 | 0.72 | 0.38 | 10% | 25 mD |

Whenever the reservoir is depleted the owner company has decided to stimulate the well either by Hydro-fracturing or Matrix stimulation. As the Hydro-fracturing is more expensive then Matrix stimulation, so it is not economically viable option to go for Hydro-frac job immediately after completion of the well. Based on your understanding design a stimulation job for all three zone considering the following parameters,

For the Sandstone (Density=169 pcf) formation containing 10 v% calcite, a 15 wt. % strength of the preflush should be injected ahead of the main acid to dissolve the carbonate minerals within the 1 ft. beyond a 0.328-ft radius wellbore. Specific gravity and viscosity of the acid solution are 1.07 and 1.5 cP respectively which is pumped down through a 2-in. inside diameter (ID) coil tubing. The formation fracture gradient is 0.7 psi/ft. Assuming a reservoir pressure of 4,000 PSi, drainage area radius of 1,000 ft., and a skin factor of 15, safety margin 300 psi.

Use 28 wt. % acid to propagate wormholes of 3 ft. from a 0.328-ft radius wellbore in a carbonate formation (specific gravity 2.71). The designed injection rate is 0.1 bbl. / min-ft., the diffusion coefficient is 10-9 m2/sec, and the density of the 28% acid is 1.14 g/cc. In linear core floods, 1.5 pore volume is needed for wormhole breakthrough at the end of the core. Use any one of the available method for treatment design.

The average density of the overburden formation (above shale) is 165 lb/ft3. Assume a tectonic stress of 2,000 Psi and a tensile strength of the sandstone of 1,000 Psi.

Your treatment design must contain minimum preflush volume is required in terms of gallon per foot of pay zone, the maximum acid injection rate using safety margin 300 psi, the maximum expected surface injection pressure at the maximum injection rate and Maximum treatment pressure for Hydro fracturing job (in case you have opted for it).

**[Refer to the questions given in the ANNEXURE-I]**

(C.O.No. 4) [Application]

**ANNEXURE-I**

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