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PRESIDENCY UNIVERSITY BENGALURU

SCHOOL OF ENGINEERING

END TERM EXAMINATION, SUMMER TERM - August 2024

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| **Semester: Summer Term** | **Date: 07/08/2024** |
| **Course Code: PET3011** | **Time: 9.30 am - 12.30 pm** |
| **Course Name: Well Intervention Technologies** | **Max Marks :100** |
| **Program: B.Tech. in Petroleum Engineering** | **Weightage: 50%** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Question paper consists of 3 parts.*
3. *Scientific and non-programmable calculator are permitted.*
4. *Do not write any information on the question paper other than Roll Number.*

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| **PART A** | | | |
| **ANSWER ANY 5 QUESTIONS 5Q X 2M=10M** | | | |
| 1 | Describe the significance of a water shut-off operation during workover procedures. | (CO1) | [Knowledge] |
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| 2 | Identify two remedial measures for wells producing with high GOR from oil zones. | (CO2) | [Knowledge] |
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| 3 | Outline the fundamental steps involved in workover planning. | (CO1) | [Knowledge] |
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| 4 | State the importance of proppants in hydraulic fracturing. | (CO3) | [Knowledge] |
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| 5 | Identify the two primary stages of a hydraulic fracturing job and state the main objective of each stage. | (CO3) | [Knowledge] |
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| 6 | Identify the various reasons for sand production. | (CO4) | [Knowledge] |
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| 7 | Define formation damage and give two examples of causes. | (CO1) | [Knowledge] |
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| **PART B** | | | |
| **ANSWER ANY 4 QUESTIONS 5Q X 10M=50M** | | | |
| 8 | Demonstrate the procedure for designing a hydraulic fracturing job to maximize the net present value (NPV) of fractured wells. Explain the steps involved in selecting fracturing fluid, proppant, and maximum treatment pressure. | (CO3) | [Comprehension] |
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| 9 | Describe the PKN model for a fracture in a well-confined pay zone. Include how this model simplifies the fracture problem, its key assumptions, and mention the average width formula. | (CO3) | [Comprehension] |
| 10 | Discuss the various mechanisms for controlling sand production in oil and gas wells. How do these mechanisms contribute to the overall effectiveness of sand control? | (CO4) | [Comprehension] |
| 11 | Demonstrate the methods used for water shut-off in wells. Briefly describe the techniques employed to seal off water production effectively. | (CO1) | [Comprehension] |
| 12 | Explain the concept of acid fracturing. How does it differ from conventional hydraulic fracturing, and what are the primary benefits and challenges associated with acid fracturing treatments? | (CO2) | [Comprehension] |
| 13 | Explain different workover techniques used to improve oil well production and explain the specific problems each technique addresses. | (CO2) | [Comprehension] |
| 14 | Demonstrate the role of gravel packing in preventing sand production. How does gravel packing address the challenges associated with sand control in different reservoir conditions? | (CO4) | [Comprehension] |
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| **PART C** | | | |
| **ANSWER ANY 2 QUESTIONS 2Q X 20M=40M** | | | |
| 15 | For the following situation, estimate the minimum required compressive strength of 20/ 40 proppant, if intermediate-strength proppant is used.  (i) Calculate the initial effective horizontal stress  (ii) Calculate effective horizontal stress under 2,000-psi pressure, and 4000-psi pressure drawdown  **Given:**   * Formation depth: 10,000 ft * Overburden density: 165 lbm/ft3 * Poison’s ratio: 0.25 * Biot constant: 0.7 * Reservoir pressure: 6,500 psi * Production drawdown: 2,000 and 4,000 psi | (CO3) | [Application] |
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| 16 | A sandstone at a depth of 10,000 ft has a Poisson's ratio of 0.25 and a poro-elastic constant of 0.72. The average density of the overburden formation is 165 lb/ft³, and the pore pressure gradient in the sandstone is 0.38 psi/ft. Assuming a tectonic stress of 2,000 psi and a tensile strength of the sandstone of 1,000 psi, calculate the breakdown pressure for the sandstone and the maximum expected surface injection pressure using the given additional data.  Specific gravity of fracturing fluid: 1.2  Viscosity of fracturing fluid: 20 cp  Tubing inner diameter: 3.0 in.  Fluid injection rate: 10 bpm | (CO3) | [Application] |
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| 17 | A sandstone with a porosity of 0.2 containing 10 v% calcite (CaCO3) is to be acidized with HF/HCl mixture solution. A preflush of 15 wt% HCl solution is to be injected ahead of the mixture to dissolve the carbonate minerals and establish a low pH environment. If the HCl preflush is to remove all carbonates in a region within 1 ft beyond a 0.328-ft radius wellbore before the HF/HCl stage enters the formation, what minimum preflush volume is required in terms of gallon per foot of pay zone? | (CO2) | [Application] |
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