UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2021

Course: Well Servicing & Workover operation   **Semester:** 7th
Program: B.Tech (APE upstream)   **Time:** 03 hrs.
Course Code: PEAU4019P   **Max. Marks:** 100

Instructions:
1. Neat diagrams must be drawn wherever necessary
2. Use a non-programmable calculator
3. There is internal choice in Q 9 & Q 11.

	SECTION A (Scan & Upload)		
Q 1	Define the following terms: a) Screenout b) Offset well	**4**	**CO2**
Q 2	State the type of clays and their formation damage mechanism.	**4**	**CO1**
Q 3	State the difference between wireline, slickline & braided line.	**4**	**CO2**
Q 4	State the typical applications of Coiled Tubing Unit operation.	**4**	**CO2**
Q 5	Elaborate about well abandonment procedure.	**4**	**CO1**
	SECTION B (Scan & Upload)		
Q 6	Draw and explain in detail surface read out of pressure variation during hydraulic fracturing job on a pressure vs. time plot	**10**	**CO4**
Q 7	Discuss the stages involved in acidization of sandstone reservoir.	**10**	**CO3**
Q 8	Define scale. Discuss the mechanism of scale formation and their detection and removal techniques.	**10**	**CO2**
Q 9	a. Elaborate about acid additives used during the acidization process. (6 marks) b. State the primary and secondary barriers used during drilling, production and well intervention operations. (4 marks) OR a. Discuss in detail various workover operations, major & minor, for oil wells. (10 marks)	**10**	**CO3**

SECTION C (Scan & Upload)

Q 10	a) A sandstone formation at a depth of 11,000 ft has a Poison's ratio of 0.25 and a poro-elastic constant of 0.71. The average density of the overburden formation is 165 lb/ft3. 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, predict the breakdown pressure for the formation.
	
	b) State the function of following downhole tools used in petroleum production operations:
	    (a) Sliding Sleeve
	    (b) Side pocket mandrel
	    (c) Landing Nipple
	    (d) Subsurface safety valve
	    (e) Flow couplings and Blast joint
	
	c) A workover job was performed in a well with steel pipe in which the packer is set at a depth of 11,000 ft. Following data are given:
	Surface temperature= 150° F
	Bottom hole temperature= 420° F
	Thermal expansion Co-efficient of steel = 7.5×10^{-6} (°F^{-1})
	After the workover job was completed, BHT reduced to 395 °F, whereas the surface temperature remained same. Calculate the change in length of the pipe (inch) after the workover job.
	d) The pore pressure and fracture gradient of petroleum formation at a depth of 4000 ft are 9 ppg and 0.75 psi/ft respectively. The overburden pressure gradient is 0.9 psi/ft. If the pore pressure declines to 8 ppg after a few years of production, what is the reduced fracture pressure of the formation?
		20	CO3

Q 11	a) It has been decided that a low-permeability formation, consisting of three separate producing zones, will have to be fractured to produce at economic rates. Before perforating, reasonable injection rates for fracturing (4 m³/min) and large pressure drops across each perforation (3.5 MPa) have been selected as being suitable. Calculate the **surface pressure** and the **number of perforations** required in each zone such that the proportion of fracture fluid entering each of the zones is proportional to the height of the zones Well data:	20	CO4

Zone	Depth (m)	Net pay thickness
A	2,130	9
B	2,225	7.5
C	2,255	14

Additional data:

Fracture gradient = 15.8 kPa/m of depth
6.5 lb/ft tubing used , Perforation ID = 0.76 cm
Fracturing fluid density = 1042 kg/cm^3
Water based fracturing fluid is used
Friction pressure losses = 8.2 kPa / m of depth
Perforation orifice coefficient = 0.9
Note: Calculate fracturing fluid surface injection pressure in kPa   (10 marks)

b) A fracture's area evolves according to a Power Law model with exponent 2/3 (KGD model; opening time distribution factor is = 1.478). The leakoff coefficient is 0.001 ft/min$^{0.5}$ and the pumping time is 40 min. Calculate the width lost because of leakoff.   (2 marks)

c) Explain the term "Water block". (2 marks)

d) Discuss the function of well control equipment's used in coiled tubing operation. (6 marks)

OR

a) Explain the detailed procedure of activating an oil well. (5 marks)

b) Explain various acid diversion techniques during matrix acidization process. (5 marks)

c) Illustrate how will you plan a workover operation on a sick well. (10 marks)