Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2018

Course: Well Stimulation **Semester:** 6th
Program: B.Tech (APE upstream)
Time: 03 hrs. **Max. Marks: 100**
No. of Pages: 4

Instructions:
1. Neat diagrams must be drawn wherever necessary.
2. Use a non-programmable calculator
3. Assume suitable data, if necessary and clearly state it.

SECTION A

S. No.		Marks	CO
Q 1	Explain the insitu rock stresses acting on an underground formation: -	**4**	**CO3**
Q 2	Explain the procedure of step rate (up) test performed during hydraulic fracturing job.	**4**	**CO5**
Q 3	A shale gas reservoir has undergone hydraulic fracturing. Using the inflow equations, drainage area concept and fracture conductivity defined skin factor following data is given below. Wellbore radius = 0.35 ft Drainage radius = 1790 ft., Skin factor = –5.85 What would be the fold of increase in well productivity after fracturing job?	**4**	**CO1**
Q 4	Define perforation and briefly explain the procedure of determining the depth of perforation: -	**4**	**CO4**
Q 5	Explain various additives used during matrix acidization process of the formation: -	**4**	**CO3**

SECTION B

S. No.		Marks	CO
Q 6	Discuss in detail different types of fracturing fluids and additives added for a 40 ton fracturing job: -	**8**	**CO6**
Q 7	Explain in detail the 3 different stages involved in hydraulic fracturing job with equipment's used: -	**8**	**CO5**
Q 8	Explain the following terms/statements: - (a) Tree Saver (b) Shaped charge (c) Fracturing fluid rheology (d) Methods to evaluate formation damage	**8**	**CO2**
Q 9	Draw and explain in detail surface read out of pressure variation during hydraulic fracturing job on a pressure Vs time plot	**8**	**CO5**

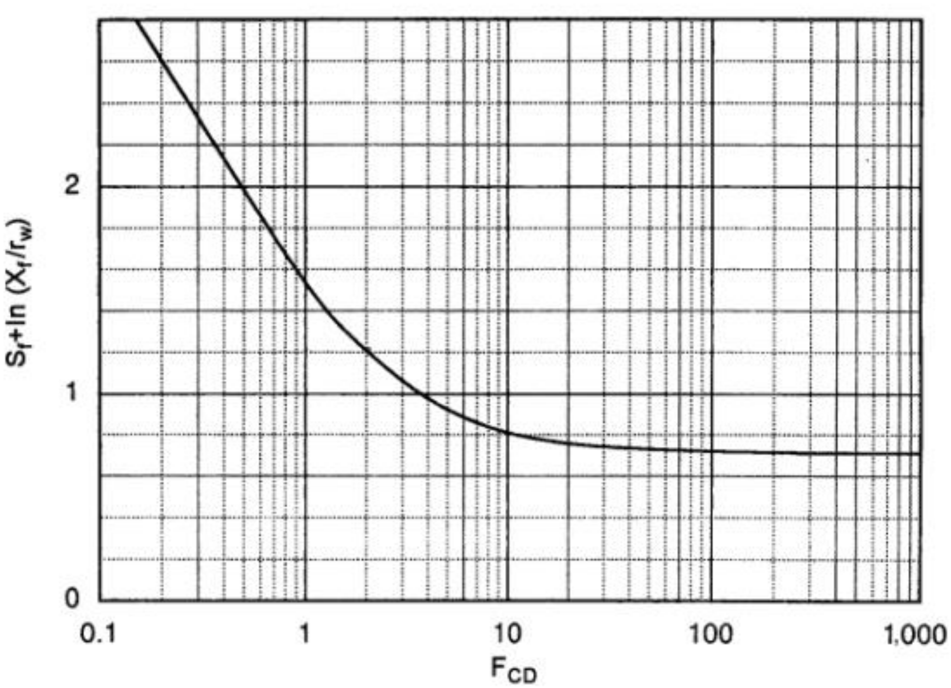
Q 10	Calculate the **skin factor** after hydraulic fracturing job from Cincoley Samaniego correlation. Also, calculate the **time (in days)** for pseudo radial flow to develop. Following data is given for the fractured well: - Reservoir permeability = 1mD Fracture permeability = 100 Darcy Fracture width = 0.25 in. Fracture half-length = 300 ft Wellbore radius = 4.25 in. Fluid viscosity = 1 cP Total compressibility (oil and rock) = 10^{-5} psi^{-1} Rock porosity = 15 % Dimensionless time from Gringarten Et Al type curve for vertically fractured well is 3	**8**	**C05**
	SECTION-C		
Q 11	(a) A sandstone 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/ft^3. 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 sandstone. (b) Given the formation sand sieve analysis as shown in figure1. Determine **median sand size & uniformity coefficient of sand**. Also **Select the proper gravel size** (i.e. gravel diameter) for a well that is expected to produce at a rate such that fluid velocity through half of open screen area is about 0.02 m/sec: - Use Schwartz gravel pack selection criteria and **mention the criteria**. (attach the figure 1 given in question paper with your answer sheet)	**10+10 =20**	**CO5**
Q 12	(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 m^3/min) and large pressure drops across all perforations (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: (see table below) Additional data:	**10+10 =20**	**CO6**

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

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
Calculate fracturing fluid surface injection pressure in kPa

(b) A sandstone with a porosity of 20 % containing 10 vol.% calcite ($CaCO_3$) 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?
Following data is given:
Molecular weight of calcite = 100.1 lb/mol
Molecular weight of HCl = 36.5 lb/mol
Density of calcite = 169 lb/ft^3
Specific gravity of HCl = 1.07

CO4



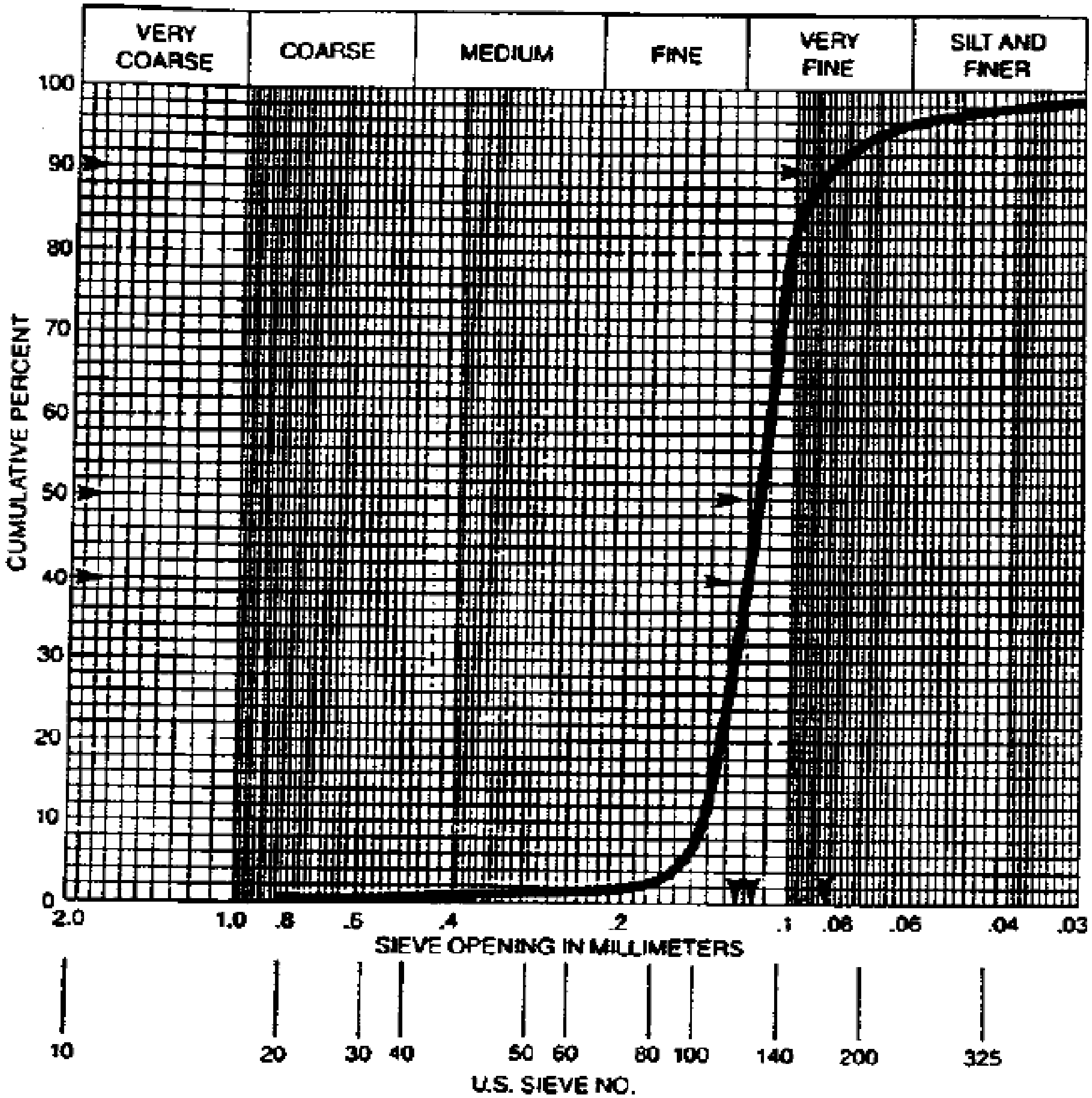


Figure 1.

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