Name: Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, Dec 2020

Programme Name: B.Tech. (APEG) **Semester :** V
Course Name : Production Engineering **Time :** 3 Hrs.
Course Code : PEAU3008 **Max. Marks :** 100
Nos. of page(s) : 5

Instructions:
1. All questions are compulsory.
2. Assume any missing data, if any

S. No.	Section - A (6x5 = 30) (Multiple Choice Question)	Marks	CO
Q1	Determine the apparent molecular weight of the natural gas. The composition of the natural gas in mole fraction: C1 = 0.805, C2 = 0.093, C3 = 0.011, i-C4 = 0.006, n-C4 = 0.002, i-C5=0.003, n-C5=0.008, C6 = 0.001, C7 = 0.001, N2=0.070. a) 17.560 b) 19.556 c) 20.612 d) 22.843	**5**	**CO1**
Q2	Determine pseudo-critical pressure of the natural gas in psia. The composition of the natural gas in mole fraction: C1 = 0.805, C2 = 0.093, C3 = 0.011, i-C4 = 0.006, n-C4 = 0.002, i-C5=0.003, n-C5=0.008, C6 = 0.001, C7+ = 0.001, N2=0.070. a) 440 b) 520 c) 670 d) 780	**5**	**CO1**
Q3	The density of the natural gas having specific gravity 0.7 at 2000 psia and 200^0F (Assume z = 0.9) in lbm/ft3 is a) 4.31 b) 5.02 c) 5.48 d) 6.37	**5**	**CO1**
Q4	When the particle size is reduced by half then terminal settling velocity a) increase by 2 times b) decreases by 2 times	**5**	**CO2**

	c) increases by 4 times d) decreases by 4 times		
Q5	For the reaction between 18 wt % HCl solution and calcite, Calculate the gravimetric dissolving power of the acid solution. a) 0.20 b) 0.25 c) 0.30 d) 0.35	**5**	**CO5**
Q6	A sandstone formation has a poison's ratio of 0.20. If the effective vertical stress acting on the formation is 9000 psi. Calculate the effective horizontal stress in psi a) 1050 b) 2250 c) 2300 d) 9000	**5**	**CO6**
	Section – B (5x10 = 50)		
Q1	Find a conical roof carbon steel tank to store 20,000 barrels of crude oil, using the API 650 standard, it is established that the outlet diameter of the liquid nozzle (Low Type) is 14''	**10**	**CO3**
Q2	Calculate absolute open flow potential and productivity index of a vertical well in an oil reservoir at steady-state radial flow conditions. The following data are given: Porosity = 0.25 Effective Horizontal Permeability = 10 md Pay Zone Thickness = 50 feet Average reservoir pressure = 5000 psia Fluid Formation volume factor = 1.2 Fluid Viscosity = 1.5 cP Drainage Area = 640 acres Wellbore radius = 0.328 feet Skin Factor = 5	**10**	**CO4**
Q3	A 20 wt % HCl is needed to propagate wormholes 2 feet from a 0.328 feet radius wellbore in a limestone formation (Specific gravity 2.71) with a porosity of 0.12. The designated injection rate is 0.12 bbl/min-ft, the diffusion coefficient is 10^{-9} m^2/sec, and the density of the 20% HCL is 1.11	**10**	**CO5**

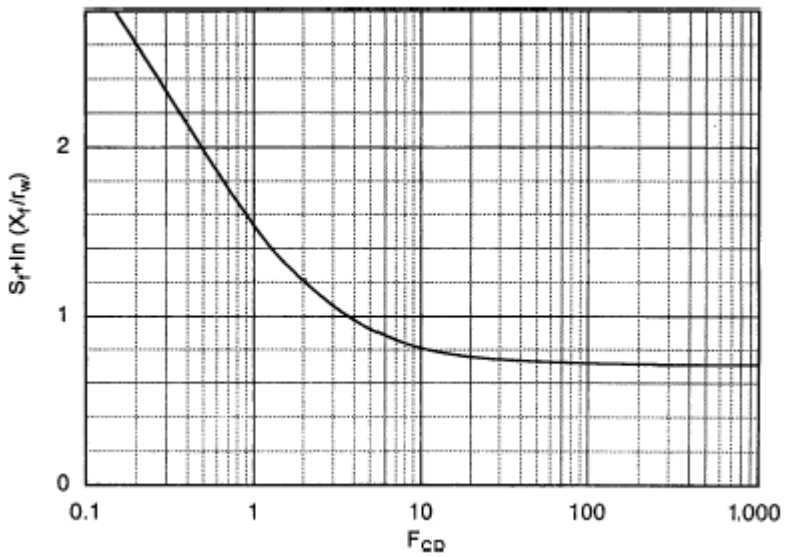
	g/cm^3. In linear core floods, 1.2 pore volume is needed for wormhole breakthrough at the end of the core. Calculate the following : a) Acid capillary number b) Acid volume requirement in gal/ft. , using volumetric model		
Q4	A gas reservoir has a permeability of 5 md. A vertical well of 0.328 feet radius draws the reservoir from center of an area of 320 acres. If the well is hydraulically fractured to create a 2000 feet long, 0.15 inches wide fracture of 200000 md permeability around the center of the drainage area. What would be the fold of increase in well productivity?  	**10**	**CO6**
Q5	Calculate the maximum width and stress intensity of a fracture with half-length is 12 m and pressurized to 21 MPa, immersed within an elastic medium with E = 1.2 GPa and poison's ratio = 0.20, and subjected to far field stress of 20 MPa	**10**	**CO6**
Section – C (1x20 = 20)			
Q1	a) Draw the schematic diagram of vertical heater treater mentioning all the sections with labelling. b) Find the effective length of the coalescing section of horizontal heater treater for the following condition: Oil flow rate: 5000 BOPD Specific gravity of oil = 30^0 API Viscosity of oil = 16 cP Diameter of the heater treater = 96 inches Inlet oil temperature = 80^0F Short-Circuit Factor (F) = 0.9 Water SG = 1.04 Inlet BS&W = 10% Outlet BS&W = 1%	**2x10**	**CO2**

Table 1 : Typical Sizes and Correspsonding Nominal Capacities for Tanks (API 650)

Tank Diameter, ft.	Capacity per ft. of Height, barrels	Tank Height (ft.) / Number of Courses in Completed Tank						
		16/2	24/3	32/4	40/5	48/6	56/7	64/8
10	14	225	335	450	-	-	-	-
15	31.5	505	755	1010	1260	-	-	-
20	56	900	1340	1790	2240	2690	-	-
25	87.4	1400	2100	2800	3500	4200	4900	5600
30	126	2020	3020	4030	5040	6040	7050	8060
35	171	2740	4110	5480	6850	8230	9600	10980
40	224	3580	5370	7160	8950	10740	12540	14340
45	283	4530	6800	9060	11340	13600	15880	18140
50	350	5600	8400	11200	14000	16800	19600	22400
60	504	8060	12100	16130	20160	24190	28220	26130
70	685	10960	16450	21950	27440	32930	-	-
80	895	14320	21500	28670	35840	35810	-	-
90	1133	18130	27220	36290	45360	-	-	-
100	1399	22380	33600	44800	-	-	-	-
120	2014	32250	48380	54200	-	-	-	-
140	2742	43900	64860	-	-	-	-	-
160	3581	57340	74600	-	-	-	-	-
180	4532	72570	-	-	-	-	-	-
200	5595	89600	-	-	-	-	-	-
220	6770	108410	-	-	-	-	-	-

Table 2 : Dimensions for Shell Nozzles in Inches. (API 650)

NPS (Size of Nozzle)	Outside Diameter of Pipe , OD	Minimum Distance From Bottom of Tank to Center of Nozzle	
		Regular Type	Low Type
60	60	64.625	60.375
54	54	58.625	54.375
52	52	56.625	52.375
50	50	54.625	50.375
48	48	52.625	48.375
46	46	50.625	46.375
44	44	48.625	44.375
42	42	46.625	42.375
40	40	44.625	40.375
38	38	42.625	38.375
36	36	40.625	36.375
34	34	38.625	34.375
32	32	36.625	32.375
28	28	34.625	30.375
26	26	32.625	28.375
24	24	30.625	26.375
22	22	29	24.375
20	20	27	22.375
18	18	25	20.375
16	16	23	18.375
14	14	21	16.375
12	12.75	19	14.375
10	10.75	17.75	13.2
8	8.625	15.75	11.2
6	6.625	13.75	9.2
4	4.5	12.125	7.875
3	3.5	10.25	6
2	2.375	9.5	5.25