Name: **Enrolment No:**	

UPES

End Semester Examination, May 2024

Course: Production Engineering II — **Semester :** VI
Program: B.Tech. (APEG) — **Time :** 3 Hrs.
Course Code: PEAU3004 — **Max. Marks :** 100

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

	SECTION - A (5Qx4M= 20 Marks)		
S. No.		**Marks**	**CO**
Q1	Define liquid holdup and no-slip liquid holdup	**4**	**CO1**
Q2	List the different section of vertical heater treater	**4**	**CO1**
Q3	Enumerate the main parts of the storage tank.	**4**	**CO1**
Q4	Show the various flow regimes in an oil reservoir using an illustrated diagram.	**4**	**CO2**
Q5	Elaborate on the function of a knockout drum in oil and gas processing facilities	**4**	**CO2**
	SECTION - B (4Qx10M= 40 Marks)		
Q6	Demonstrate the significance of processing oil and gas necessary? Briefly explain the functions of processing equipment utilized in a typical well site processing facility	**10**	**CO3**
Q7	Discuss the following attributes of the flow measurement devices with examples. a) Accuracy b) Linearity	**10**	**CO3**
Q8	Distinguish between the bubble flow and slug flow regimes in multiphase vertical flow in oil and gas wells.	**10**	**CO4**
Q9	Select a conical roof carbon steel tank to store 20,000 barrels of crude oil, using the API 650 standard, it is suggested to use “low type” nozzle with nozzle size 14.	**10**	**CO4**
	SECTION - C (2Qx20M= 40 Marks)		
Q10	a) Explain each character of the sucker road pumping unit designated using string of characters as shown below:	**2x10=20**	**CO3**

	A-160D-173-54 **b)** SRP units are categorized according to the configuration of the lever. Illustrate the arrangement of first, second, and third-order levers using a schematic depiction.		
Q11	A 0.70 specific gravity gas flows from a 2-in. pipe through a 1.5-in. nozzle-type choke. The upstream pressure and temperature are 120 psia and 75^0F, respectively. The downstream pressure is 90 psia (measured 2 feet from the nozzle). The gas-specific heat ratio is 1.2. Assume $N_{Re} = 10^{5.}$ Calculate the following: a) Which flow regime exists in nozzle-type choke? b) What is the value of C_D? c) What is the daily flow rate? d) What is the temperature at choke downstream? Take $Z_{up}/Z_{outlet} = 1$ e) What is the expected pressure at the nozzle outlet?	**5x4 =20**	**CO4**

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