


Name:			
Enrolment No:			
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES End Semester Examination, May 2022			
Course: Advanced Production Engineering Program: B. Tech APE upstream Course Code: PEAU3019		Semester: 6 Time : 03 hrs. Max. Marks: 100	
Instructions: There is internal choice in Q9 & Q11			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	Define the following terms: a) retention time b) water wash	4	CO1
Q 2	Draw a diagram of a centrifugal compressor and name its parts	4	CO2
Q 3	Draw the head vs. Flow rate graph for a reciprocating pump & centrifugal pump	4	CO2
Q 4	List the three things necessary for an emulsion to exist.	4	CO3
Q 5	List the four primary methods of separating water from crude.	4	CO4
SECTION B (4Qx10M= 40 Marks)			
Q 6	Name the equipment, draw any one schematic sketch and explain the process in brief, in which oil must be held at a temperature for a specific period of time to enable de-emulsifying the water in-oil emulsion.	10	CO3
Q 7	a) Write four important objectives of stage separation in a surface production facility b) Estimate the free settling velocity (in ft/hr) of a 100 μm brine drop in oil. Following data is given: Specific Gravity of oil = 0.8, viscosity of oil = 10 cP, Specific Gravity of brine = 1.02	10	CO4
Q 8	a) State the types of storage tank used in oil and gas industry. Explain the operation, design and parts of any one in detail. b) Elaborate about corrosion control of storage tank	10	CO5
Q 9	Draw the process diagram for glycol dehydration and explain the design considerations.	10	CO6
OR			

	Discuss the potential operating problems during operation of a vertical separator		
SECTION-C (2Qx20M=40 Marks)			
Q 10	<p>a) Discuss in detail about vessel internal parts of a two-phase separator</p> <p>b) Size a vertical 2 phase separator to determine diameter & seam to seam length of it. Following data is given:</p> <p style="padding-left: 40px;">Gas flow rate = 10 mmscfd @ 0.6 specific gravity Oil flow rate = 2000 bopd @ 40 °API Operating Pressure of vessel = 1000 psia Operating Temperature of vessel = 60 °F diameter of droplet size to be removed = 140 μm Viscosity = 0.013 cP Gas compressibility factor = 0.84 Drag coefficient = 0.851</p>	20	CO5
Q 11	<p>a) State the primary and secondary condition for hydrates formation</p> <p>b) State the function of baffles used in shell & tube heat exchanger</p> <p>c) Discuss about estimation of settling velocity of water with the law applicable</p> <p>d) Following data is given:</p> <p style="padding-left: 40px;">Gas flow rate = 25 mmscfd Oil flow rate = 3000 bopd Operating Pressure = 800 psig Operating Temperature = 80 F Flowing gas density = 3.4 lb/ft³ (for 20.3 Molecular Weight gas) Flowing oil density = 51.5 lb/ft³ (40 °API)</p> <p>Two phase separator is used. Calculate the diameter of vessel (in ft) and liquid capacity (in bbl/day). Assume 10 ft shell height of separator which is 30% liquid full. The value of constant, depending upon design and operating conditions, is 0.3</p> <p>e) Define emulsion and emulsifying agents. State and explain the factors on which stability of emulsion depends upon.</p>	20	CO6

OR

- a) Discuss about the type of devices used for measurement of oil and gas flow rate.
- b) A liquid hydrocarbon (having density = 788.4 kg/m^3 & viscosity = $5.857 \times 10^{-7} \text{ kg/m-sec}$) flows through a pipe with inner diameter 4 cm and orifice meter installed to measure volumetric flow rate. Discharge coefficient is having the value of 0.61. The 2 pressure taps are connected to Hg U – tube manometer (density of Hg = 13600 kg/m^3) and column height difference is 11 cm. The ratio of orifice diameter to pipe diameter is 0.75. Calculate volumetric flowrate of hydrocarbon.

- c) Size a horizontal 3 phase separator. Following data is given:

Oil flow rate = 5000 bpd @ 30 °API

Water flow rate = 3000 bpd @ 1.07 specific gravity

Gas flow rate = 5 mmscfd @ 0.6 specific gravity

Operating pressure = 100 psia

Operating temperature = 90 °F

Retention time of oil = retention time of water = 10 min

Viscosity of oil = 10 cP & Viscosity of water = 1 cP

Gas density = 0.3 lb/ft^3 & Liquid density = 54.7 lb/ft^3

Drag coefficient = 2.01 & Gas compressibility factor = 0.99

Droplet removal criterion is 100 microns liquids, 500 microns H₂O and 200 microns oil. Vessel is half full of liquid.