FINAL EXAM

NAME: _____

Problem			POINTS
1.	(a)	(5 pts)	----------------
	(b)	(5 pts)	----------------
	(c)	(5 pts)	----------------
	(d)	(5 pts)	----------------
	(e)	(10 pts)	----------------
	(f)	(10 pts)	----------------
	(g)	(10 pts)	----------------
	(h)	(10 pts)	----------------
3.		(20 pts)	-----------------
4.		(20 pts)	-----------------
TOTAL		(100 pts)	------------------

1.- ANSWER THE FOLLOWING QUESTIONS WITH A BRIEF EXPLANATION

A.- (5 pts.) Why is it useful to determine the gross profit when analyzing a process at the input-output level structure? Specify two reason. Why the gross profit will increase or decrease when we look at the later stages of process design?

B.- (5 pts.). Indicate at least two characteristics of the chemical industry, which determine other two design features of chemical processes.

Characteristic of Chemical Industry	Characteristic of Process Design	Reasoning the interrelationship

C.- (5 pts.; 1 punto cada pregunta / 1 pto each)

- **In a Batch or Semicontinuous process, when it makes sense the use of units in parallel?**

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- **A G-L absorber would be designed assuming H (high) = 4D (Diameter)?**

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- **How will the vapor recovery of a key component change in a flash unit as the pressure is increased and the temperature is kept constant?**

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- **It makes sense to calculate two diameters of a distillation column? Explain your answer.**

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- **What are the differences in the equations giving the degree of separation of any component in a distillation equipment and in a Flash equipment?**

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D.- (5 pts.) Indicates the main decision levels and their corresponding contents in the batch plant design.

E.- (10 pts). Suppose that the design of a separation by distillation of the components A and B get the height of the column exceeds the maximum of 60 m: Draw the distillation systems in that conditions. Suppose that in another design to separate C of D, the distillation column exceeds the maximum of 3 m in diameter: Draw the distillation systems in that new conditions.

F.- (10 pts.). Draw two alternative process flow diagrams for separating an ethanol / water mixture of 8% ethanol to obtain pure (99.98%) ethanol. Indicate the input and output streams, levels of P and T (high or low) in each stream and indicate the points in the process (equipment and / or stream) with greater influence in the process costs.

G.- (10 pts). Given the T vs. H Figure: What is the name of this kind of representation? Respect to the heat exchange network design, mark on the Figure and by a short text all the information available from the Figure. Indicate how you could physically change the slope of the hot composite curves to modify cooling needs.
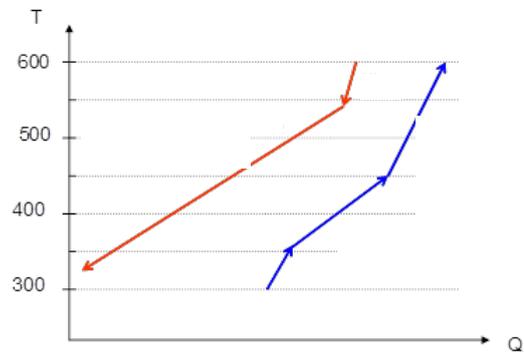
H.- (10 pts).- In the petrochemical industry, the production of high octane gasoline can be made by alkylation process of ISO-BUTANE with olefins as BUTENES coming from GLP dehydrogenation units. The alkylation of BUTENE to obtain ISO-OCTANE takes place together a competitive reaction that produces C12 in the same conditions of P, T and liquid phase. The feed stream of BUTENE + ISO-BUTANE contents small quantities of N-BUTANE and PROPANE that are inerts. Draw the Douglas diagram in the level 2, 3 and 4.

2.- (20 pts). Consider the flash equipment of the figure with recycle of process when 50% bottoms product is recycled. Estimate the Base Module Cost (Base Module Cost = BMC) in 2014 of the flash vessel built using carbon steel, when the vapor rate is 85% of the speed of flooding, the coefficient Csb,f = 0.2 ft/s and the ratio H/D = 2.
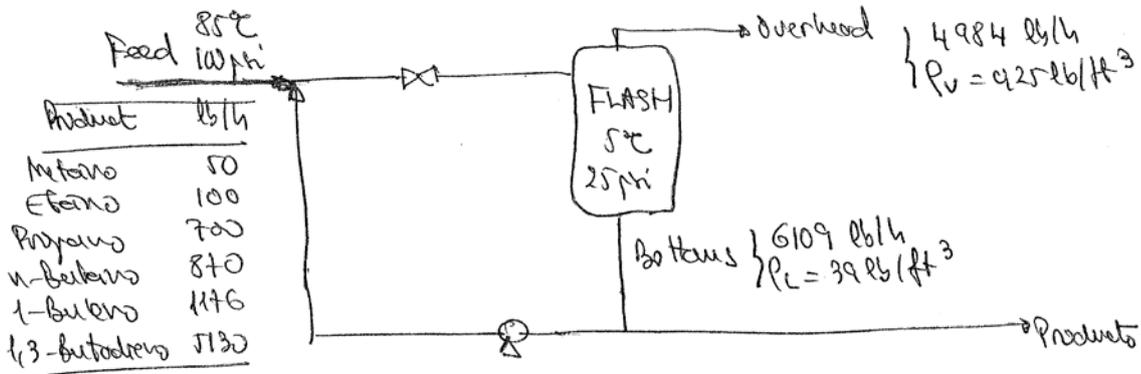
3. (20 pts). Given are two compressors as shown in the Figure below that handle a flow of 1.1 kgmol/s. Assuming ideal gas behavior and electric motors as drivers, calculate the total brake horsepower required by the two compressors (in kW), as well as the outlet temperature in each compressor. Also, if the electricity cost is $0.05/kWh and the service factor is 0.917, what is the annual cost of electricity for running these compressors?