ROLL NO.	

PRESIDENCY UNIVERSITY, BENGALURU
SCHOOL OF ENGINEERING

Max Marks: 40 | Max Time: 120 Mins | Weightage: 40 %

ENDTERM FINAL EXAMINATION

I Semester AY 2017-18 | Course: **PET 203 PROCESS ENGINEERING CALCULATIONS** | 20 DECEM 2017

Instructions:

i. Write legibly

ii. Scientific and non-programmable calculators are permitted

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Part A

[4 Q x 10 M= 40 Marks]

1. Define the following

i.	Thermochemistry	ii.	System	iii.	Exothermic Process
iv.	Endothermic Process	v.	Hess law of Summation	vi.	Heat of combustion
vii.	Heat of capacity	viii.	Latent Heat	ix.	Limiting reactant
x.	Excess reactant				

2. i. Write a short notes on batch, semi-batch and continuous process [6M]

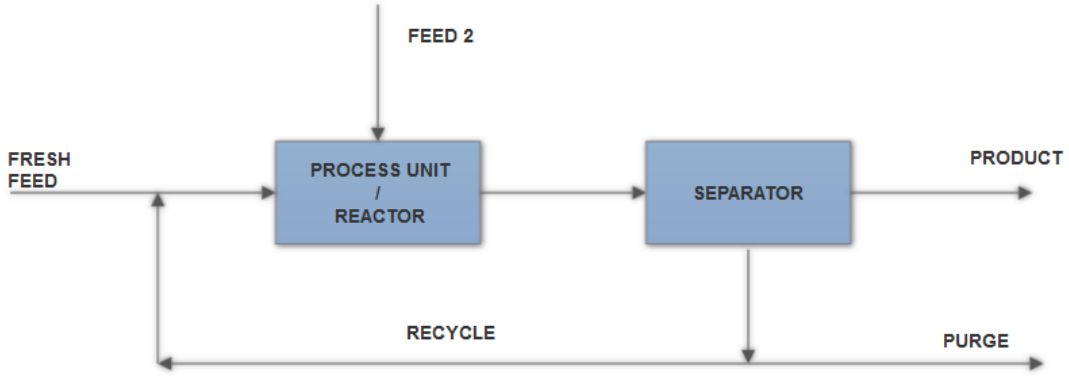
   ii. Draw a flowchart of a mixer with three feed streams and an output stream. If three feed streams are flowing in to mixer with a flow rate of 50, 60, 40 liters per hour of water respectively. What will be flow rate of output stream of mixer [4M]

3. A producer gas made from coke has following composition by volume:

CO	28%
CO2	3.5%
O2	0.5%
N2	68%

   Producer gas is burned with such a quantity of air that the oxygen from the air is 20% in excess of the net oxygen required for complete combustion. If the combustion is 98% complete, calculate the mole percentage of the gaseous products formed for 100 gmoles of producer gas burned.

4. Fresh feed and recycle enters the reactor along with the feed 2 as shown in figure below



In reactor following reactions can take place

$A + 2B \longrightarrow 2C$

$2C + B \longrightarrow 2D$

Quantity of feed 2 is 20 moles of B/hr. Quantity of fresh feed is 12 moles of A/hr. Total quantity of feed entering reactor is 20 moles of B/hr and 16 moles of A/hr. Reaction in reactor takes place in such a way that A is 50% consumed, quantity of D formed is 3 moles/hr. If recycle quantity is equal to purge quantity, after 1 hr of reaction find the following

i. Amount of recycle.

ii. Amount of output from the reactor.

iii. Amount of products from the separator.

iv. Yield if C is desired based on A fed.

v. Selectivity if C is desired and D is undesired.

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Max Marks: 20 | Max Time: 60 Mins | Weightage: 20 %

TEST 2

I Semester 2017-2018 | Course: **PET 203 Process Engineering Calculations** | 27-10-2017

Instructions:

i. Write legibly

Part A

(2 Q x 4 M= 8 Marks)

1. a) Define latent heat of vaporization. Write Clausius-Clapeyron equation with its terms.
b) The vapor pressure of Ethyl ether (M.Wt 74) is 185 mm of Hg at 0℃. The latent heat of vaporization is 92.5 cal per gram at 0℃. Calculate the vapor pressure at 35℃

2. a) What is Raoult's law? Write its equation with its terms.
b) Estimate the reduced pressure and temperature of chloroform at normal boiling point of 61.2°C if critical temperature and pressure are 536.6°K and 54 atm respectively.

Part B

(2 Q x 6 M= 12 Marks)

3. Myristic acid is to be distilled at a temperature of 200℃ by use of superheated steam. It may be assumed that the relative saturation of the steam with acid vapors will be 80%

a) Calculate the weight of steam required per 1 lb of acid vaporized if the distillation is conducted at an atmospheric pressure of 740 mm of Hg.
b) Calculate the weight of steam per lb of acid if a vacuum of 26in Hg is maintained in the apparatus.

Vapor pressure of Myristic acid (228 M.Wt) at 200℃ = 14.5 mm Hg

4. Air at a temperature of 20℃ and a pressure of 750 mm of Hg has a relative humidity of 80%.

a) Calculate the molal humidity of the air.
b) Calculate the molal humidity of this air if its temperature is reduced to 10℃ and its pressure increased to 35psi, condensing out some of the water.
c) Calculate the weight of water condensed from 1000cuft of the original wet air in cooling and compressing to the conditions of part b.
d) Calculate the final volume of the wet air of part c.

Vapor pressure of water: 17.5 mm Hg at 20℃, 9.2 mm Hg at 10℃

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Max Marks: 20 | Max Time: 60 Mins | Weightage: 20 %

TEST 1

I Semester 2017-2018 | Course: **PET 203 Process Engineering Calculations** | 23 SEPT 2017

Instructions:

i. Write legibly

Part A

(5 Q x 1 M= 5 Marks)

1. Define closed and opened system.
2. What is Avogadro's hypothesis?
3. Define limiting reactant and excess reactant.
4. What will be the absolute pressure when atmospheric pressure is 1atm and measuring gauge shows 14.70psi?
5. Write Baume's gravity scale expression for liquids lighter and heavier than water

Part B

(2 Q x 2.5 M= 5 Marks)

6. Assuming the applicability of the ideal gas law calculate the maximum temperature to which 10 lb of nitrogen enclosed in a 30 cu-ft chamber may be heated without the pressure exceeding 150 psi.
7. Air is assumed to contain 79% nitrogen and 21% oxygen by volume. Calculate its density in grams per liter at a temperature of 70°F and a pressure of 741 mm Hg.

Part C

(1 Q x 10 M= 10 Marks)

8. A solution of sodium chloride in water contains 430 g of Nacl per liter at 20℃. The density of the solution at this temperature is 1.21g/cm^3. calculate the following (density of water at 20℃ is 0.998 g/cm^3)
   a) Composition in weight percent
   b) Volumetric percent of water
   c) Composition in mole percent
   d) Composition in atomic percent
   e) Kgs of Nacl per kg of H2O