I B. Tech I Semester Regular Examinations, January, 2015

Fundamentals of Bioprocess Computations
(Biotechnology)

Time: 3 hours   Max Marks: 70

PART – A
Answer ALL questions
All questions carry equal marks
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2 * 10 = 20 Marks

1). a   Define the role of API gravity scales in Petroleum Industries.   **[2]**

b   Mention the units for Mass and Volumetric flow rate.   **[2]**

c   Define Pressure with units.   **[2]**

d   Write about Raoults Law.   **[2]**

e   What is the molecular weight of Phosphorous and Sulphur?   **[2]**

f   A combustion reactor is fed with 50kmol/h of butane and 2000 kmol/h of air.   **[2]**
Calculate the % excess air used and composition of the gases leaving combustion
reactor assuming complete combustion of butane?

g   Write about the applications of Ideal Gas Law.   **[2]**

h   How many moles of sulphuric acid will contain 64 kg of Sulphur?   **[2]**

i   Define Energy with units.   **[2]**

j   A sample of gas having volume of 1 m^3 is compressed to half of its original volume.   **[2]**
The operation is carried for a fixed mass of gas at constant temperature. Calculate
the percent increase in pressure?

PTO…

PART – B
Answer any FIVE questions
All questions carry equal marks
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5 * 10 = 50 Marks

2. a) 98 grams of sulphuric acid (H_2SO_4) are dissolved in water to prepare one litre of **[10]** solution. Find the normality and molarity of solution?
   b) Find the grams of HCl needed to prepare 1 litre of 2N HCl solution?

3. a) Ethanol and water forms azeotrope containing 96% ethanol by weight. Find the **[10]** composition of azeotrope by mole percentage?
   b) The available nitrogen (N) in the urea sample is found to be 45% by weight. Calculate the actual urea content in the sample?

4. a) A gas mixture contains 0.274 kmol of HCl, 0.337 kmol of N_2 and 0.089 kmol of **[10]** O_2. Calculate (a) Average molecular weight of gas and (b) Volume occupied by this mixture at 405.3kPa and 303K?
   b) A cylinder contains 15 kg of liquid propane. What volume in m^3 will propane occupy if it is released and brought to NTP conditions?

5. A gas mixture has the following composition by volume: SO_2 = 8.5 %, O_2= 10% and **[10]** N_2= 81.5%. Find (a) the density of gas mixture at a temperature of 473 K and 202.65 kPa g and (b) composition by weight?

6. The dry bulb temperature and dew point of ambient air were found to be 302 K and **[10]** 291 K respectively. Barometer reads 100kPa. Calculate: (a) the absolute molal humidity, (b) the absolute humidity, (c) the % RH, (d) the % saturation, (e) the humid heat and (f) the humid volume?

7. The waste acid from a nitrating process containing 20% HNO_3, 55% H_2SO_4 and 25% **[10]** H_2O by weight is to be concentrated by addition of concentrated sulphuric acid containing 95% H_2SO_4 and concentrated nitric acid containing 90% HNO_3 to get desired mixed acid containing 26% HNO_3 and 60% H_2SO_4. Calculate the quantities of waste and concentrated acids requires for 1000 kg of desired mixed acid?

8. Ethylene oxide is prepared by oxidation of ethylene. 100 kmol of ethylene and 100 **[10]** kmol of O_2 are charged to a reactor. The percent conversion of ethylene is 85 and percent yeild of C_2H_4O is 94.12. Calculate the composition of product stream leaving the reactor. The reactions taking place are: $C_2H_4 + ½ O_2 \rightarrow C_2H_4O$ and $C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$.

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