Mass and Energy Balances in Biochemical Engineering (BBL133)

Minor I

Full Marks 20 **Time: 14:30 – 15:30**

Venue: LH325 **Date: 02.09.2015**

1. a) Is it possible to measure weight of a loaded truck and micronutrients required for 1L media using same weighing balance? Justify your answer.

   b) State two major differences between accuracy and precision.

   c) Draw the time profiles of product and biomass concentrations for growth associated, mixed growth associated and non-growth associated product formation.

   [5]

2. Methanogens present in the anaerobic digester use volatile fatty acids to produce methane.

   $$CH_3COOH + NH_3 \rightarrow \text{Methanogens} + CO_2 + H_2O + CH_4$$

   The composition of methanogen is similar to typical bacterial composition. For each kg acetic acid consumed, 0.67 kg CO_2 is evolved. How does the yield of methane under these conditions compare with the maximum possible yield?

   [6]

3. A growth associated product ($CH_{1.56}O_{0.31}N_{0.25}$) is produced using aerobic recombinant *E. coli* in a 100 L fermenter. Glucose and ammonia are used as carbon and nitrogen sources, respectively. The yield of biomass ($Y_{x/s}$) from glucose is 0.5 g/g; the yield of product from glucose is about 20 % of biomass yield ($Y_{x/s}$).

   a) How much ammonia is required?

   b) What is the oxygen demand?

   c) At same $Y_{x/s}$, how much different are the ammonia and oxygen requirements for *E.coli* unable to synthesise the product?

   [9]