## OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE

B.Sc. (Food Engineering) Degree Examination, 2011/2012 Session FDE 206: INTRODUCTION TO FOOD SCIENCE AND ENGINEERING Rain Semester, January 2013. Time Allowed: 2<sup>1</sup>/<sub>2</sub> Hours

## **INSTRUCTION:** Answer ANY FOUR QUESTIONS

- 1. (a) What do you understand by the term "Transport phenomena"?
  - (b) State and discuss the three conservation laws that form the basis of transport accounting.
  - (c) State the law of conservation of mass in the form of a simple but generalized equation.
  - (d) Simplify the equation further stating your assumptions.
- 2. A membrane separation system is used to concentrate total solids in a liquid food from 9% to 31%. The concentration is accomplished in two stages with the first stage resulting in release of a low-total-solids liquid stream. The second stage separates the final concentration product from a low-total-solids stream, which is returned to the first stage. The recycle stream contains 2.5% total solids, the waste stream contain 0.5 % total solids and the stream between the stages 1 and 2 contains 24% total solids. The process is designed to produce 100 kg/min of 31% solids.
  - (a) Sketch the system.

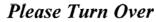
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- (b) Hence or otherwise, determine the magnitude of the recycle stream.
- 3. Determine the amounts of lean beef, pork fat and water that must be used to make a stated quantity of frankfurter. The composition of the raw materials and frankfurter are as follows:

Lean beef: 14% fat; 67% water; 19% protein Pork fat: 89% fat; 3% protein; 8% water Frankfurter: 15% protein; 20% fat; 65% water

- 4. (a) A Food Engineer is working on the development of a new dryer. Describe how the following engineering terms relate to the machine development:
  - (i) model (ii) prototype (iii) actual system (iv) scale-up (v) similitude
  - (b) Results from experiments on a model can be applied to the prototype only if complete similarity exists between the two. Mention and briefly discuss each of these similarities.
  - (c) Discuss any two methods of dimensional analysis and highlight the inherent advantages and disadvantages of each of the methods.
  - (d) What is a non-dimensional number? Give two examples.







- 5. (a) State the Buckingham's Pi theorem.
  - (b) Liquid flows through pipes and channels are affected by the following variables:

| Description                          | Units  |  |
|--------------------------------------|--|--|
| Pressure drop Average fluid velocity | M/LO <sup>2</sup><br>L/O   |  |
| Slot length                          | L  |  |
| Fluid density                        | M/L <sup>3</sup><br>M/L <del>O</del>                                   |  |
|                                      | Pressure drop Average fluid velocity Slot depth Slot length Slot width | Pressure drop Average fluid velocity Slot depth Slot length Slot width Fluid density |

Generate Pi - terms from the variables using the above theorem.