BSC ENGINEERING: FIRST SEMESTER EXAMINATIONS, 2016-2017
DEPARTMENT OF FOOD PROCESS ENGINEERING
FPEN 201 INTRODUCTION TO FOOD PROCESS ENGINEERING (3 CREDITS)

INSTRUCTIONS:

ANSWER SECTION A AND TWO QUESTIONS FROM SECTION B
TOTAL TIME TWO HOURS

SECTION A (Answer all questions)

1. The discipline of food process engineering has seen several developments in the past 35 years. What are the core functions of a Food Process Engineer? Using four examples describe critical advances in the field. (12 marks)

2. In many communities you can encounter the drying of different food commodities. As an Engineer show why this process is important in ensuring food security. (8 marks)

3. Malt from cereals are produced as intermediate products for further processing. For a batch operation, using corn, *Zea mays,* provide a description of the processes for the small-scale manufacture of dried malt. Draw a labelled flow diagram to represent the operations. (10 marks)

4. A dairy processing plant is interested in producing 100 kg of low fat cream (15% fat). The raw materials available for the plant are cream (45% fat) and fresh milk (3.5% fat). Calculate how much of the cream and fresh milk will be required to make the product.

   Assume all concentrations are in weight per weight (w/w). (10 marks)

SECTION B (Answer two questions)

5.

   a. The laws of conservation of mass and energy are frequently used in analyzing processing operations. Discuss this statement using the processing of cassava into gari, dry cassava flour and fermented cassava dough.

   b. In a fruit juice plant, the juice may be pumped through a heat exchanger, first it is heated and then cooled. Comment on the heat energies affecting this process.

c. Moisture determination is one of the critical analytical methods for collecting data for computations in food process engineering. Discuss the basic principles and the use of the moisture balance for data collection.

6. In a village cooperative cassava operation, dry flour and fermented cassava dough, *'agbelima'* were produced. Fresh cassava, 400.50 kg; 357.85 kg, 250 kg and 339.50 kg respectively were obtained from four farmers and pulled together for the day's processing. The resulting peeled cassava weighed 1000.50 kg and 45% of this was used in making *agbelima* whilst the rest was used to produce dry cassava flour of 11% moisture.

   In the processing of *agbelima*, an inoculum was added to the cassava during grating at the rate of 2.5% (w/w). Grating was repeated once for each batch of cassava and followed with a 3-day fermentation during which the mass lost 8% of the water. Assume: *that the fresh cassava contains 45% moisture; that the inoculum contains the same amount of water as the fresh cassava and that there was 7.4% loss of material during grating,*

   Do a complete material balance over the cassava process.

7. A second year food process engineering student used the rising film evaporator to concentrate tomato juice into puree. In a typical operation the tomato juice was drawn into the sample chamber and steam was applied under vacuum. The steam condensed and the volume of water from the condensed steam and temperatures were measured. The following data was collected.

Material	Initial Temp. (°C)	Final Temp. (°C)	Amount Collected, mL
Steam	100	45	990
Cooling Medium	-18	4	
Condensate	29	23	875

- Temperature of water vapour from feed is 35 °C
- Latent heat of water at 100 °C = 2,260 kJ/kg
- Latent heat of water at 35 °C = 2,420 kJ/kg
- Latent heat of fusion of water = 335 kJ/kg
- Specific heat of water =4.2kJ/kg

Calculate

- Heat released by steam, i.e. heat input by steam
- Heat used in the system from the amount of water evaporated
- The amount of ice melted to cool the condensate