



# TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

## UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN FOOD TECHNOLOGY & QUALITY ASSURANCE

BSFQ13S AND BSFQ14S2

### AFS 4312: FOOD ENGINEERING III

#### PAPER 1

Type unit code : Type unit name.

END OF SEMESTER EXAMINATION

**SERIES:** APRIL 2016

**TIME:** 2 HOURS

**DATE:** Pick Date Select Month Pick Year

#### Instructions to Candidates

You should have the following for this examination

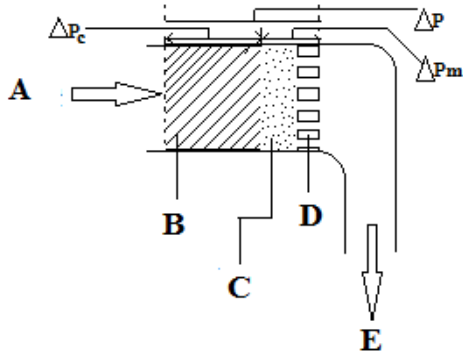
-Answer Booklet, examination pass and student ID

This paper consists of Choose No questions. Attempt Choose instruction.

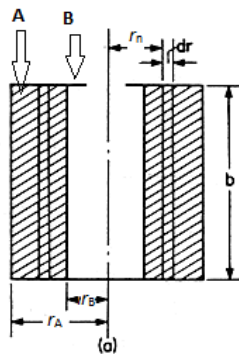
**Do not write on the question paper.**

#### Question ONE

- (a) Given that Centrifugal Force is expressed as  $F_c = mr\omega^2 = (mv^2)/r = 0.011 mrN^2$ , state the meaning of all the symbols used in the equation **(5 Marks)**
- (b) State FIVE requirements of a good filter medium **(5 Marks)**
- (c) Write short notes on Concentration polarization as used in Ultra Filtration **(5 Marks)**
- (d) The Figure below shows how filtration takes place in a food industry, name all section represented by the symbols (A, B, C,D E and  $\Delta P$ ) **(6 Marks)**



(e) Given the following cross section of a centrifuge, and that  $dF_c = (dm)r\omega^2$  while  $dP = \rho\omega^2 r dr$ , derive the equation for the determination of neutral radius **(9 Marks)**



## Question TWO

(a) The equation for Rate of mass Transfer in Reverse Osmosis is given by:

$$J = \frac{dw}{dt} = \left(\frac{K_w}{x}\right) A(\Delta P - \Delta \Pi) = KA(\Delta P - \Delta \Pi), \text{ state the meaning of the symbols in the equation}$$

**(6 Marks)**

(b) A solution of sucrose in water at 25°C is to be concentrated by reverse osmosis. It is found that, with a differential applied pressure of 5000kPa, the rate of movement of the water molecules through the membrane is  $25 \text{ kg m}^{-2} \text{ h}^{-1}$  for a 10% solution of sucrose. Estimate the flow rate through the membrane for a differential pressure of 100,000 kPa with the 10% sucrose solution and also estimate the flow rate for a differential pressure of 10,000 kPa but with a sucrose concentration of 20%.

**(14 Marks)**

### **Question THREE**

With an aid of a clear labelled diagram discuss the design and mode of operation of a Disc Bowl Centrifuge including advantages and disadvantages **(20 Marks)**

### **Question FOUR**

With an aid of a clear labelled diagram discuss the design and mode of operation of a horizontal plate pressure filter including advantages and disadvantages **(20 Marks)**

### **Question FIVE**

An oil is to be extracted from 100kg of soya beans in a counter-current contact stage apparatus using hexane. If the initial oil content of the bean is 18% and the final extract is to contain 40% of the oil and if 90% of total oil is to be extracted:

Calculate the number of contact stages that are needed using the stage by stage mass balance method. Assume that equilibrium is reached in each stage and the crashed bean solid in the sold retain in addition half of their weight of solution after each solute stage. **(20 Marks)**