THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A constituent of JKUAT)
Faculty of Applied and Health Sciences
DEPARTMENT OF PURE AND APPLIED SCIENCES
UNIVERSITY EXAMINATION FOR THE DEGREE OF
BACHELOR OF TECHNOLOGY IN APPLIED CHEMISTRY

ACH 4318 : UNIT OPERATION

SPECIAL/SUPPLEMENTARY EXAMINATION

FEBRUARY 2013 SERIES   2 HOURS

Instructions to candidates:

This paper consist of **FIVE** questions
Answer question **ONE** (compulsory) and any other **TWO** questions

Question ONE

a) Differentiate between filtration and sieving   **(3marks)**

b) State:-

   (i)   Characteristic of falling rate period   **(3marks)**

   (ii)   Factors which influences rate of filtration   **(2marks)**

c) Sketch 1-1 pass straight tube heat exchanged and its temperature length graph. **(4marks)**

d) A quarts mixture was screener through a standard 20 mesh screen. The cumulative analysis reveal that the mass fraction of component A in feed, overflow and underflow was 0.57, 0.75 and 0.195 respectively. Calculate mass flow rate of underflow.

   (5marks)

e) Discuss briefly TWO mechanism of filtration   **(3marks)**

f) Define the following terms:-

   (i)   Equilibrium moisture contest   **(2marks)**

(ii)   Double effect evaporation   **(2marks)**

(iii)   Nucleation   **(2marks)**

g)   A triple effect evaporator is used to concentrate on organic colloids. The temperature of steam to the first effect is 110°C, the boiling point of solution in the test effect 52°C, the overall heat transfer co-efficient in w/m² °C are 2,500, 2000, and 2000 in the 1ˢᵗ, 2ⁿᵈ and 3ʳᵈ effect respectively.   **(4marks)**

Question TWO

a)   Give fouriers equation and state the meaning of symbols   **(4marks)**

b)   Briefly explain how to achieve supersaturated solution   **(3marks)**

c)   Hot air at 120°C blows over shot plate 50 by 75cm maintain at 250°C the convection heat transfer co-efficient is 250w/m°C calculate rate of heat transfer   **(4marks)**

d)   (i)   With the help of a diagram describe the working of hammers mill. **(4marks)**

(ii)   Define combination   **(8marks)**

e)   The temperature of fluid A entering heat exchanger was 373K while its exit temperature was 350K. the temperature of fluid B estering same exchange was 280K while its exit temperature was 310K. Fluid A flow though the tube while B through the shell. Assuming counter current flow calculate log mean temperature difference LMTD.

(4marks)

Question THREE

a)   A plane wall constructed of solid iron with thermol conductivity 70 w/m°C thickness 50mm and with surface area 1m by 1m temperature 150°C on one side and 80°C on other. Calculate the rate of heat transfer (5marks)

b)   Differentiate between natural convection and forced convection   **(3marks)**

c)   Outline importance of size Reduction   **(3marks)**

d)   With the help of a diagram describe the working of continues crystallizer **(5marks)**

e)   An organic compound distill in steam at 98°C and external pressure of 760mmHg and produce distillate containing 20% by mass of organic compounds. Calculate Rmm of organic compound given vapour pressure of water as 733mmHg.   **(4marks)**

Question FOUR

a)   State properties of filter medium.   **(3marks)**

b) With the help of a diagram explain the working of falling film evaporator. **(5marks)**

c) A drying oven is constructed of 500mm thick mild steel of thermal conducting of 45w/m ˚C and insulate with 25mm thick magnesia of thermal conductivity of 0.06 w/m˚C calculate inside temperature of the oven if the rate of heat loss through the wall per unit area is 96watts per m2 and room temperature 20˚C. **(6marks)**

d) Define the following terms

    (i)   Wet bulb thermometry   **(2marks)**

    (ii)   Saturated vapour   **(2marks)**

    (iii)   Invariant crystals   **(2marks)**

Question FIVE

a) A 5-horse power motor was used to ground 80% sugar crystal which passes a 500mm sieve to 80% passes through 80mm sieve. Calculate power required to grind so that 80% passes through a 125 mm sieve **(5marks)**

b) Discuss advantages and disadvantages of cryogenic separations. **(5marks)**

c) Discuss briefly different centrifugal separations methods. **(8marks)**

d) Differentiate between diffusion heat transfer and radiation heat transfer. **(2marks)**