Technical University of Mombasa

Faculty of Applied and Health Sciences

DEPARTMENT OF PURE AND APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN APPLIED CHEMISTRY

BTAC 12J/M & BTAC 11M

ACH 4303 : UNITS OPERATIONS

SEMESTER EXAMINATION

DECEMBER 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 :-
   (i) Differential and sink/float setting methods
   (ii) Pseudoplastic and dilatants fluids
   (iii) Depth and surface filtration

(12marks)

b) State :-
   (i) Characteristic of potential floor **(2marks)**
   (ii) Factors affecting screen effectiveness **(3marks)**

c) Sketch 1-2 heat exchanger and its temperature length curve **(3marks)**

d) A quarts mixture was screened through a10 mesh screen. The mass fraction of component A in feed, overflow and underflow was found to be 0.47, 0.85 and 0.195 respectively. Calculate mass flow rate of underflow and overflow to the feed. **(4marks)**

e) A flat furnace is constructed with 0.714M layer of Sil-O- Cel brick with thermal conductivity of 0.138w/m˚C. The temperature of inner face of the wall is 760˚C and that

of outer wall is 76.6˚C. Calculate temperature of interface between Sil-O-Cel brick and common brick. **(4marks)**

f) With the help of equation define permeability co-efficient **(2marks)**

QUESTION TWO

a) Define :-
   (i) Mechanism of dialysis **(3marks)**
   (ii) Asymmetric membrane **(2marks)**
   (iii) Conduction as mechanism of heat transfer in solid and liquid **(3marks)**

b) Air at 20˚C blows over what late 50 by 75cm maintain at 350˚C. Calculate rate of heat transfer given heat transfer co-efficient as 250 w/m˚C. **(4marks)**

c) Differentiate between ideal and actual screen. **(4marks)**

d) Define
   (i) Viscosity
   (ii) Fluid
   (iii) Average temperature

(4marks)

QUESTION THREE

a) Explain pervaporation process **(4marks)**

b) 60mm bore tube of thickness 0.03mm thick was used as heat exchanged. Given thermal conductivity of material as 0.055 w/m˚C.
   Calculate
   (i) Log mean radius
   (ii) Log mean area
   (iii) Rate of heat transfer per unit length

(7marks)

c) Define sedimentation and classify edimentation process. **(5marks)**

d) Differentiate between Turbulance and laminar flow **(4marks)**

QUESTION FOUR

a) The temperature of hot and cold fluid entering double pipe heat exchanger were 340K and 270K and respective exist temperature were 310K and 290K. Calculate log mean temperature difference if the two fluid flow in co-current manner. **(4marks)**

b) Outline
   (i) Different techniques of crystallization
   (ii) Objective of crystallization **(8marks)**

c) Define

(i) Fraction crystallization
(ii) Ideal rectification plate
(iii) Mc-cable thiele method

(6marks)

d) Define distillation **(2marks)**

QUESTION FIVE

a) Crude oil having density of 8.692g/cm^3 flows through three piping system. Pipe A 50mm with cross section area of 2.17 x $10^{-3}m^2$, pipe B 75mm in diameter with cross sectional area of 4.77 x $10^{-3}M^2$ and two pipe C each with 38mm with cross sectioned area of 1.31 x $10^{-3}m^2$. Equal quantity of liquid flows though pipe C the volumetric flow rate through pipe A is 6.65m^3 per hour calculate
   (i) The mass flow rate through pipe A **(3marks)**
   (ii) Velocity through pipe B **(2marks)**
   (iii) Mass velocity through pipe A **(2marks)**

b) Explain briefly:
   (i) Crystallization process
   (ii) Reverse cosmosis
   (iii) Batch sedimentation

(7marks)

c) Describe the working of vacuum crystallizer **(4marks)**

d) Used stokes equation to explain how rate of sedimentation can be reduced. **(2marks)**