



KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2011/2012

FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE
SCH 421: REACTOR DESIGN

DATE: Thursday 8th December, 2011

TIME: 8.00 a.m. – 10.00 a.m.

INSTRUCTIONS

Answer ALL Questions.

Question 1. (Total 18 Marks)

a.) Define the following terms.

- i. Optimal process variables.
- ii. Transition type reactors.
- iii. Eddy diffusion.

(6 Marks)

b.) Distinguish between,

- i) Through put and production rate.
- ii) Rate of reaction and Specific rate of a reaction.
- iii) Auto thermal and isothermal reactors.

(12 Marks)

Question 2. (20 Marks)

a) With regard to ideal batch stirred tank reactors and ideal plug flow tubular reactors, compare there

- i) Constructional features.

(4Marks)

- ii) Material balance . (4Marks)
- iii) Heat balance. (4Marks)
- iv) Operation time. (4Marks)
- v) Overall chemical transformation based on these reactors. (4Marks)

Question 3. (16 marks)

a) Give plausible reasons for the following observations

- i) It is usually of practical importance to consider the fractional conversion of the limiting reactant. (2marks)
- ii) The least expensive reactant is taken in excess when composition of the feed is chosen when determining fractional conversion. (2marks)

b) i) What is yield as an efficiency criteria of a chemical process.(2 marks)

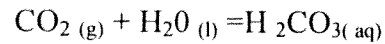
ii) Give the general expression for calculating yield for concurrent and consecutive reactions.. (4marks)

iii) Determine the yield of product R For the following chemical transformation,

$2A + B = 2R + S$,where the starting quantities of reactants are $n_{A,O}=15$ Kmol and $n_{B,O}=30$ Kmol. The stream leaving the reactor contains 16 kmol of product R and under the existing set of conditions the equilibrium feed contains 2.5 kmols of reactant A. (6marks)

Question 4. (16 Marks)

- a.) In a kinetic study of formation of carbonic acid as result of the hydration of CO_2 an end product of metabolism, the following reaction takes place.



- i). Give an expression for the rate equation (2marks)
 - ii). Determine the order of the reaction (2marks)
 - iii) Based on the information given classify the reaction in all possible ways. (2marks)
 - iv). What types of reactor based on the above factors will you recommend for industrial production of carbonic acid. (2 marks)
- b. Consider a second order reaction
- i.) What factors will the rate of reaction depend on (2marks)
 - ii) Give an expression for the above dependants. (2marks)
 - iii) What type of reactors do you expect to fulfill the above conditions (4marks)

THE END.