



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCES

DEPARTMENT OF APPLIED CHEMISTRY

CHEMICAL ENGINEERING PLANT DESIGN

SCH 4108

End of First Semester Examination Paper

December 2015

This examination paper consists of 4 pages

Time Allowed: 3 hours
Total Marks: 100
Special Requirements: Graph paper
Examiner's Name: Mr. B. Nyoni

INSTRUCTIONS

1. Answer all questions in Section A and any other three questions from Section B.
2. Each question carries 20 marks.
3. Show steps clearly in any calculation.
4. Start the answers for each question on a fresh page.
5. Use of calculators is permissible.

MARK ALLOCATION

QUESTION	MARKS
1.	20
2.	20
3.	20
4.	20
5.	20
6.	20
TOTAL POSSIBLE MARKS	100

Copyright: National University of Science and Technology, 2015

SECTION A

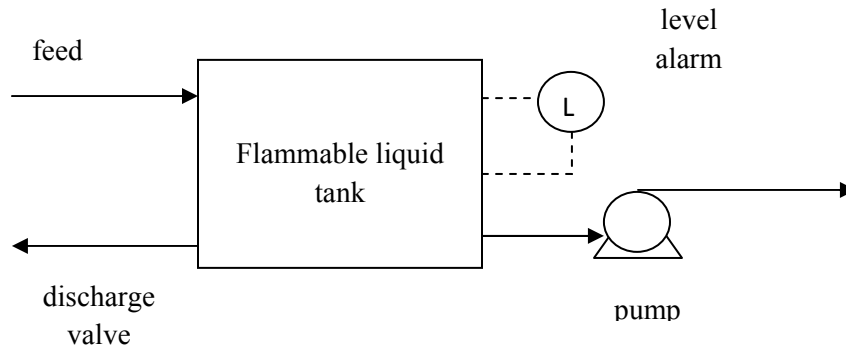
1 (a) Explain the following hazard identification and reduction methods :

(i) HAZOP study

(ii) FTA method

[6]

(b) A HAZOP study is presented for the plant section shown below.



Equipment reference	Deviations from operating conditions	What event could cause this deviation	Consequences of this deviation	Additional implications	Process indicator
Flammable liquid tank	1. Level drops	(i)	(vi)	Damage to pump Fire	Level alarm Fire alarm
		(ii)	(vii)		
		(iii).....	(iix)		
	2. Level rises	(iv)	(ix)	Fire	Level alarm
		(v)	(x)		

Write down the statements that will appear in the table sections (i) up to (x)

[10]

(c) What are the two major drawbacks of the HAZOP study. [4]

2. The precedence table for activities involved in producing a computer game is shown below. An activity network is to be drawn to model this production process.

Activity	Must be preceded by ..
A	-
B	-
C	A
D	A, C
E	A
F	E
G	E
H	G
I	D, F
J	G, I
K	G, I
L	H, K

(a) Explain why it is necessary to use at least two dummies when drawing the activity network. [4]

(b) Draw the activity network using exactly two dummies. [16]

SECTION B

3 (a) What is the difference between computer simulation and animation. [6]

(b) Give two examples each, of computer simulation and animation. [4]

(c) List two advantages and disadvantages of computer aided design [4]

(d) List three simulation packages commonly used by academics and engineers. [3]

(e) State and explain three factors affecting the selection of a simulation package. [3]

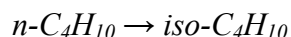
4 (a) Using a diagram describe the stages of a design process. [10]

(b) List and explain the two methods of data collection. [6]

(c) Explain why a design process is often referred to as an iterative process [4]

5 (a) Explain the term degrees of freedom. [3]

(b) In estimating the composition of a liquid and vapor phases when n-butane isomerizes at 311 K (100°F), it is required to first determine the number of degrees of freedom for the system. Assume that the reaction occurs in the vapor phase.



Determine the number of degrees of freedom. [3]

(c) A hold tank is installed in an aqueous effluent-treatment process to smoothen out fluctuations in concentration in the effluent stream. The effluent feed to the tank normally contains no more than 100 ppm of acetone. The maximum allowable concentration of acetone in the effluent discharge is set at 200 ppm. The surge tank working capacity is 500 m³ and it can be considered to be perfectly mixed. The effluent flow is 45,000 kg/h. Suppose the acetone concentration in the feed suddenly rises to 1000 ppm, due to a spill in the process plant, and stays at that level for half an hour. Calculate the concentration of acetone (in ppm) in the effluent discharge? [14]

6 (a) Discuss any two categories of estimating capital investment. [6]

(b) Explain the difference between fixed and working capital [6]

(c) Parametes for two heat exchangers, 1 bought in 1990 and the other in 1995, for the same service are as follows:

	A	B
Area (m ²)	70	130
Time	1990	1995
Cost (\$)	17000	24000
CE Index	358	381

What is the cost of a 80m² heat exchanger today. CE Index is 589. [8]

END OF PAPER!!!!