



# NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCE

DEPARTMENT OF APPLIED CHEMISTRY

CHEMICAL ENGINEERING PLANT DESIGN

SCH 4108

Supplementary Examination Paper

August 2015

This examination paper consists of 3 pages

**Time Allowed: 3 hours**

**Total Marks: 100**

**Special Requirements: None**

**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
<b>TOTAL</b>	<b>100</b>

Copyright: National University of Science and Technology, 2014

## **SECTION A**

**1 (a)** Explain the following terms in relation to Chemical Engineering Plant Design:

- (i) Design objective
- (ii) Design constraint. [4]

**(b)** With aid of a diagram, outline the anatomy of a chemical manufacturing process. [13]

**(c)** List any three operations involved in the feed preparation stage. [3]

**2.** A project consists of the following eight activities whose durations are as follows:

<b>Activity</b>	A	B	C	D	E	F	G	H
<b>Duration</b>	4	4	3	5	4	1	6	5

The precedence relations are as follows:

B must follow A

D must follow A and C

F must follow C and E

G must follow C and E

H must follow B and D

- (a) Draw an activity network in which the activities are represented by vertices. [8]
- (b) Find a critical path by inspection, and write down the earliest and latest starting times for each activity. [12]

## **SECTION B**

- 3 (a)** What is the difference between computer simulation and animation, give an example of each. [8]
- (b)** List two advantages and disadvantages of computer simulation. [4]
- (c)** Giving an example of a simulation package you have used, list the general steps for creating a reactor design simulation. [8]
- 4 (a)** List any four items of information that can be extracted from an MSDS about a certain material. [4]
- (b)** Discuss any two methods for analyzing hazards in industry. [8]
- (c)** Explain any three factors that affect the choice for plant location. [8]
- 5 (a)** Explain the term degrees of freedom. [3]
- (b)** 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  $500 \text{ m}^3$  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 (in ppm) in the effluent discharge? [17]
- 6 (a)** Explain the term inflation. [4]
- (b)** Explain the difference between fixed and working capital. [6]
- (c)** Use the six tenths rule to estimate the approximate water pump price that will flow 500gpm of water through a 10 psi head, given that, the cost of a similar pump that achieves  $0.5 \text{ m}^3/\text{min}$  flow costs \$3200. No motor is to be included in the price. [1gal =  $0.0045 \text{ m}^3$ ] [10]

**END OF PAPER!!!!**