NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCE

DEPARTMENT OF APPLIED CHEMISTRY

CHEMICAL ENGINEERING PLANT DESIGN

SCH 4108

First Semester Examination Paper

December 2014

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**
TOTAL	**100**

SECTION A

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

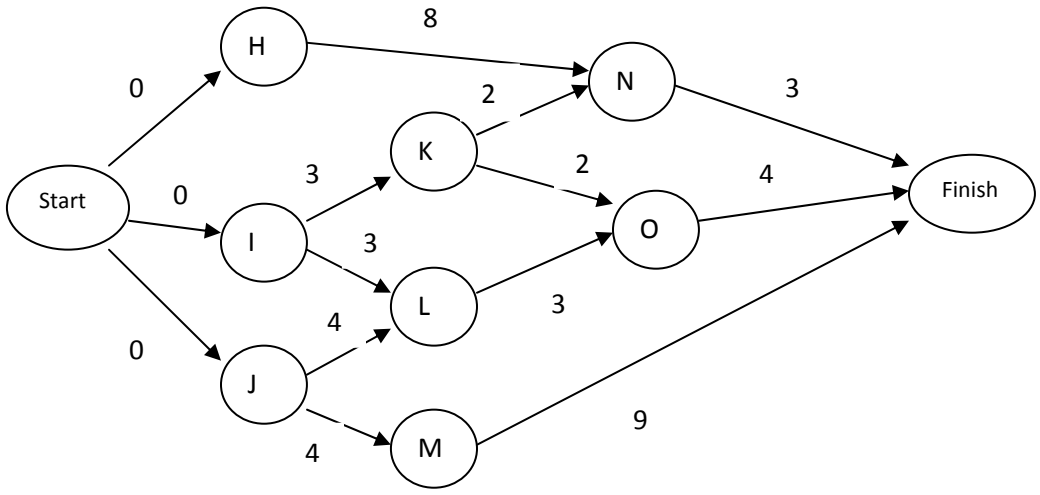
(i) The need

(ii) Design constraint. [4]

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

(c) List any three methods of storing a product in a process. [3]

2 (a) A project consists of the following activity network in which the vertices represent activities and the numbers next to the arcs represent time in days.



Assuming that an unlimited number of workers is available, write down:

(i) the minimum completion time

(ii) the corresponding critical path [18]

(b) List any two projects where critical path method can be applied. [2]

SECTION B

3 (a) Define the following terms

(i) Computer simulation

(ii) Flow-sheeting [8]

(b) List two advantages and disadvantages of computer aided design [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) Describe and explain the three types of design. [7]

(b) List and explain the two types of design reports. [5]

(c) Rephrase the following common statements found in design reports to a proper language.

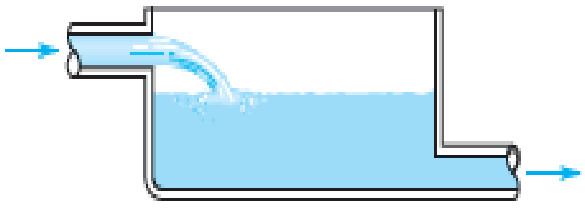
(i) We designed the absorption tower on the basis of . . .

(ii) A complete list of the results are given in the Appendix.

(iii) The data is analysed using …… [8]

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

(b) The tank shown in the diagram below contains 5000 litres of water in which initially 55 kg of salt is dissolved. Brine runs in at a rate of 50 l/min and each litre contains 2.5 kg of dissolved salt. The mixture in the tank is kept uniform by stirring. Brine runs out at 50 l/min.



(i) Find the amount of salt in the tank at any time *t*.

(ii) Make a plot of the amount of salt versus time. [17]

6 **(a)** Discuss any two factors that affect the investment and production costs. [6]

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

(c) The purchased cost of a heat exchanger of 450 m^2 area in 1990 was $25000.

(i) Estimate the cost of the same heat exchanger in 2001 the two indices given below.

(ii) Comment on the results

	1990	**2001**	
Marshall and Swift Index	915	1094	
Chemical Engineering Plant Cost Index	358	397	[8]

END OF PAPER!!!!