

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF APPLIED CHEMISTRY

END OF SECOND SEMESTER EXAMINATIONS – APRIL/MAY 1999

CHEMICAL ENGINEERING PLANT DESIGN – SCH 4108

TIME: THREE HOURS

INSTRUCTIONS TO CANDIDATES

Answer ALL questions.

1. What factors are to be considered in making a feasibility survey for proposed process design? (10 marks)
2. What is *fixed capital investment*? (10 marks)
3. What is meant by a *Process Flow Diagram*? What is a *Process Flow Diagram* supposed to indicate to a layperson? (10 marks)
4. (a) Briefly describe what is meant by *Plant Start Up*. What precautions must be carried out during Plant-start up so as to avoid a catastrophe. (10 marks)
(b) During a start-up on a Chemical Plant in the US in the mid-fifties, a vessel exploded and fragments of the explosion could be found about five kilometres away. Discuss what could have contributed to the catastrophe. (10 marks)
5. What is a *P* and *I* diagram? Draw sketches to indicate manual valve, flow recorder, level controller and a pressure controlled valve. (10 marks)
6. What are the main steps in the design of a heat exchanger? What precautions does one take in the design of a heat exchanger? Describe the arrangement of pipes in any heat exchanger. (10 marks)
7. A pipe 50m long is to be constructed to convey a fluid density of 1080kg m^{-3} at a fluid velocity of $0.0025\text{m}^3 \text{sec}^{-1}$ between two horizontal points. The pipe is made of carbon steel and the temperature of the fluid between the conveyance points ranges between 93°C and 148°C . Select a pipe to be used for the job from the accompanying tables.

The pressure drop must not be more than 0.0562 Mpa .

$$\Delta P = \phi \left(\frac{L}{D} \right) \left(\rho \frac{V^2}{2} \right)$$

1 inch = 25.4mm

(10 marks)

8. Describe in detail how you go about in the design of an *Ammonia Producing Plant* or a *Methanol Synthesis Plant*. (20 marks)

END OF QUESTION PAPER!!!