

May 2013 National Exams

**04-Chem-A5, Chemical Plant Design and Economics**

3 Hours Duration

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Notes:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper a clear statement of the assumptions made.
2. Any non-communicating calculator is allowed. This is an OPEN BOOK exam. The primary reference text is M.S. Peters and K.D. Timmerhaus, *"Plant Design and Economics for Chemical Engineers" Fifth Edition.*
3. The questions are of equal value. The candidate will answer any five of the seven questions. Only five questions that you answer will be marked.
4. Most questions require an answer in essay format. Clarity and organization of the answer are important

**1) Estimation of Total Product Cost (20 marks)**

**When one carries out an economic analysis of proposed process investment it is necessary to develop an accurate estimate of total product cost. This cost is usually divided into two broad categories. What are the main costs that must be considered in these two categories? What is the difference between total product cost and marginal cost? When is it appropriate to use marginal cost?**

**2) Depreciation (20 marks)**

**Depreciation is an important factor in the on-going finances of a corporation. Describe what depreciation is with respect to the federal income tax liability of a corporation. What is the difference between Current Value, and Salvage value and what is Recovery Period**

**3) Risk Assessment in Project economic assessment (20 marks)**

**There is only one thing that is constant in this world and that is change. Between the time that a major investment is initially considered and the time the unit is on-stream and on-spec can be as much as five years or more. It is critical during the economic analysis of the potential viability of the project that potential risk be considered. There are procedures that assist in this, describe two.**

**4) Process selection (20 Marks)**

**During the synthesis stage of a process development, one is usually faced with having to compare process alternates. Although capital cost is important what other factors might also be considered?**

**5) Health, Safety, Loss protection and Environmental issues (20 Marks)**

**For each of these important areas, give an example of one aspect along with a brief description as to what is involved**

**6) Software in Process Development and Design (20 Marks)**

**Flowsheet simulators such as Invensys PRO/II and Aspen Hysys are used extensively in process development and design. There are many other types of software that are now considered essential not only for the design process but for subsequent plant operation, and operation. Describe briefly at least two other types of software.**

**7) Separation Equipment Design (20 Marks)**

**The vast majority of chemical processes require separation of mixtures into their constituent chemical species. In the petroleum refining industry most streams consist of an enormous number of chemicals so other criteria are used. Discuss at least three commonly used separation processes . What are the main criteria for selecting one over another.**