



## ChE 140

### Chemical Process Industries

**Course Description:** Survey of the different industrial chemical processes. Unit processes & operations in chemical industries. Mass and energy balances in industrial processes.

**Course Prerequisite:** ChE 125, ChE 132, ChE 133, ChE 134

**Course Credit:** 3.0 units (2 h lecture, 3 h laboratory)

#### Program Educational Objectives (BS Chemical Engineering)

The program aims to educate students such that three to five years from graduation, they:

1. take leadership roles in their respective fields and/or effectively work in or manage a team;
2. are equipped with the extensive knowledge and relevant skills necessary to succeed in their chosen careers and to become responsive citizens;
3. are able to demonstrate strong research & innovative capability as they recognize and address opportunities and challenges in their respective spheres of influence;
4. have shown strong commitment to the ethical practice of their profession; to health, safety and environment; and service to society.

#### Course Outcomes

At the end of this course, the students must be able to:

1. Identify and describe unit operations and unit processes involved in chemical industries;
2. Solve industrial stoichiometry problems using the concepts in mathematics, chemistry, and elementary chemical engineering principles (i.e. mass and energy balance);
3. Write a paper on the assigned chemical industry, focusing on its current industry and market profile, manufacturing processes of the plant, and their developments;
4. Report on the actual health, safety, and environment (HSE) practices being implemented on the assigned chemical industry; and
5. Present the corporate social responsibilities of the company and the industry as a whole.

#### Student Outcomes Satisfied by Course Outcomes

- [a] Ability to apply knowledge of mathematics and science to solve engineering problems
- [e] Ability to identify, formulate, and solve engineering problems
- [g] ability to communicate effectively
- [h] Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

#### Course Outline

##### 1.0 Industrial Stoichiometry

(6.5 weeks)

- 1.1 Sulfur Compounds
  - 1.1.1 Sources of Sulfur
  - 1.1.2 Overview of Sulfur Processes
  - 1.1.3 Burning of Raw Sulfur
  - 1.1.4 Roasting of Pyrites
  - 1.1.5 Bisulfites and Sulfates
  - 1.1.6 Sulfuric Acid Production

#### Long Examination 1

- 1.2 Nitrogen Compounds
  - 1.2.1 Sources of Nitrogen
  - 1.2.2 Overview of Nitrogen Processes
  - 1.2.3 Ammonia Synthesis
  - 1.2.4 Ammonia Oxidation
  - 1.2.5 Nitric Acid Production
- 1.3 Lime and Cement
  - 1.3.1 Sources of Lime and Cement
  - 1.3.2 Calcination Process

## Long Examination 2

### 2.0 Survey of the Chemical Process Industries

(9.5 weeks)

- 2.1 Industry and Market Profile – Market and Economics
  - 2.1.1 Overview of the industry\*, its product and processes
  - 2.1.2 Basic market data (i.e. production, import, export)
  - 2.1.3 Economics of production
  - 2.1.4 Market segmentation (based on product application)
  - 2.1.5 Market competition
  - 2.1.6 Global market outlook (i.e. rationalization, globalization)
- 2.2 Manufacturing Process – Technical Description of the Unit Processes and Operations
  - 2.2.1 Raw materials
  - 2.2.2 Manufacturing process and process flow diagram (including process controls)
  - 2.2.3 Equipment description (Equipment specifications sheets)
- 2.3 Others
  - 2.3.1 Health, Safety, and Environment (HSE)
    - 2.3.1.1 Occupational safety (if applicable)
    - 2.3.1.2 Process safety (including safe handling of chemicals)
    - 2.3.1.3 Waste management
  - 2.3.2 Research and Development – On-going R&D and Future Innovations
    - 2.3.2.1 Product development
    - 2.3.2.2 Process development
    - 2.3.2.3 Market development

### List of Industries

1. Adhesives
2. Agrochemicals (pesticides)
3. Agrochemicals (fertilizers)
4. Bio-diesel (only one source, coconut oil or Jathropa)
5. Cement
6. Coatings (paint and printing inks)
7. Glass
8. Personal Care (hygiene and cosmetics including lotions and bath soap)
9. Petroleum Refining
10. Poly-Olefins: Polyethylene-PE, Polypropylene-PP and Polybutylene-PB (Petrochemicals)
11. Plastics (PP or PE-based)
12. Geothermal Power Plant
13. Fuel (bunker oil or diesel) or Coal-fired Power Plant
14. Pulp and Paper
15. Polyvinyl chloride (PVC) and its products
16. Rubbers (Natural, synthetic, compounding, latex)

17. Soap and detergents
18. Oils, fats, and waxes (edible oil, incl. virgin coconut oil)
19. Sugar milling and refining
20. Dairy products
21. Powdered drinks (e.g., coffee, milk and other combinations) or Beverages (carbonated or fruit juices)
22. Beer or Wine
23. Sauces and other food condiments or Preserved Fruits (dried fruits for export)
24. Steel manufacturing
25. Industrial gases

## Course Assessment

### Part 1

Quizzes & Homeworks	10%
Long Examinations (2)	35%

### Part 2

Consultations	35%
Oral Presentation	10%
Final Paper	10%
Mandatory Plant Visit	

## Course Policies

### Part 1 – Industrial Stoichiometry

1. Long quizzes may be closed- or open-book exams. Necessary tables and figures shall be agreed upon prior to the examination date. Schedules of long quizzes shall be announced by your respective instructors.
2. Grievances regarding checked long quizzes shall be entertained only within three (3) days upon the return of papers or announcement of scores. Any grievance will not affect the grades if it is raised after the 3-day grace period.
3. There will be no make-up long quiz or class work. For missed long quizzes with valid excuse, an excuse letter supported by valid documents (e.g. medical lab results) must be provided. Only one (1) missed long quiz is allowed.
4. Use of mobile phones (texting and answering calls) and other electronic gadgets during the lecture is strictly prohibited.

### Part 2 – Chemical Process Industries

1. A milestone plan for CPI part shall be provided to guide the students in managing the project study.
2. Selection of topics shall be done by draw lots (one student per industry). A student is not allowed to change topic without prior approval from the adviser.
3. A plant visit is a mandatory requirement for better understanding of the industry. Conduct your plant visit between 27-Jan to 26-Feb 2016. The plant visit should be completed prior to your consultation schedule. No plant visit, no consultation. A copy of plant visit certificate or any confirmation letter must be presented during Phase-1 consultation and should be attached to the final document (hard copy).
4. Schedule of consultations – There shall be three (3) major consultations. Changes in the schedule shall be communicated immediately and will be posted on FB Group Page and DChE Admin Bulletin Board
5. Written report
  - a. Reports shall be written per phase, i.e. P1, P2, and P3. A draft of each phase report shall be submitted a day before the scheduled consultation. No draft, no consultation. The draft should be in .doc format (Word processed), not PDF.
  - b. The DRAFT of the Final Report (soft copy) – this is a compilation of all phase reports (P1, P2 & P3) – shall be submitted by email.
  - c. The FINAL REPORT (hard copy required) shall be submitted a week after each individual oral presentation.
  - d. Format of the written report. The final written report should also be in .doc format (Word-processed) and wire-bound with a transparent front cover. The format shall be as follows.
    - I. Title Page
    - II. Acknowledgment

- III. *Table of Contents*
  - IV. *List of Tables and Figures*
  - V. *Limitation of Study*
  - VI. *The three (3) phases of the report (Refer to Table 1)*
  - VII. *Works Cited*
  - VIII. *Attachment of some important market data references*
- e. All references and materials used should be properly cited, including attachment of screenshots and photocopies of some important market data references,
6. **Oral Report**
- a. The medium of instruction is strictly English
  - b. The dress code is business attire for the reporter.
  - c. The formal presentation should be in MS PowerPoint, must not have animations and must not contain sounds and videos. Only a maximum of 20 slides excluding title, acknowledgement, and references slides shall be allowed.
  - d. The oral report must last for 20 minutes. A 5-minute question and answer shall follow.
7. **Panel.**
- a. There shall be a panel to review the written document and the oral presentation. There shall be three (3) panel members per reporter.
  - b. During the oral report, each panelist is required to ask at least two (2) sensible questions. The panelist shall be graded according to the quality of the discussion that ensues from his/her questions.
  - c. The adviser shall provide each panel an e-copy of the reporter's draft.

**General Class Policies**

1. Students should comply with the schedule of consultation and oral presentation. No-show during these activities shall merit a grade of zero.
2. All requirements should be submitted on time. A 3.0% deduction per day in the final grade shall be given per late submission of all requirements.
3. A maximum of six (6) absences shall be allowed (excused and unexcused) for this course. A student incurring more than six (6) absences shall either be dropped from the course if his/her standing is passing or be given a grade of 5.0 if his/her class standing is failing. University rules on absence, cheating, dropping and LOA shall apply. Attendance will be checked every meeting
4. Attendance in all the sessions of the oral presentation is a must. A student should not miss any session. Should s/he miss an oral presentation, s/he is required to attend another session of the same topic/s.
5. Tardiness is not allowed. Anyone who comes in 15 minutes after the class has started shall be considered absent.
6. Please be courteous enough to come on time during oral presentations. Doors will be closed 15 minutes after the first presentation has started.
7. Use of cellphones/mobile phones (texting or answering calls) or any electronic gadget during the oral presentation is strictly prohibited. Only the adviser and reporter are allowed to use his/her laptop computer.
8. The instructors may change class policies when deemed necessary. These changes shall be discussed with the students for mutual agreement.

**Grading System**

1.00	1.25	1.50	1.75	2.00	2.25	2.5	2.75	3.00	5.00
[92,100]	[88,92)	[84,88)	[80,84)	[76,80)	[72,76)	[68,72)	[64,68)	[60,64)	[0,60)

**List of Instructors**

Prof. Charlimagne Montealegre  
 Engr. Michael Sean Deang  
 Engr. Bemboy Subosa  
 Engr. Antonio Rivera  
 Engr. Carmelita Villanueva

## References

1. Basta, N. *Shreve's Chemical Process Industries, 6<sup>th</sup> Ed.* McGraw-Hill Publishing Company Inc., USA, 1997.
2. Benett, H. *The Chemical Formulary : Collection of Commercial Formulas for Making Thousands of Products on Many Fields.* Chem.Pub, USA, 1992.
3. Buchel, K.H. *Industrial Inorganic Chemistry.* Wiley-VCH. 2000.
4. Kirk, Othmer. *Chemical Technology and the Environment.* Wiley, USA. 2007.
5. Kirk, Othmer. *Concise Encyclopedia of Chemical Technology.* Wiley, USA. 2007.
6. Kent, J.A. *Riegel's Handbook of Industrial Chemistry.* Reinhold, USA. 1992.
7. Lewis, W.K., et al. *Industrial Stoichiometry: Chemical Calculations of Manufacturing Processes, 2<sup>nd</sup> Ed.,* 1954.
8. Lipton, S., Lynch, J. *Handbook of Health Hazard Control in the Chemical Process Industry.* Wiley, USA. 1994.
9. Soares, C. *Process Engineering Equipment Handbook.* McGraw-Hill, USA. 2002.
10. Wang, L.K., et al. *Waste Treatment in the Process Industries.* CRC/Taylor & Francis, USA. 2006.