

Policies Regarding Management of the Course and Computer Usage

1. A late penalty of 10 % of the total available points/day will be applied for works turned after due date and hour. Maximum late penalty is 50%. After a solution is posted, no credits will be given.
2. You could use any electronic means and machine language to solve the assigned work. I am only interested in the technical quality of the engineering solutions and their efficient communication. However, I will discuss the pros and cons of software/hardware for your benefit.
3. The quality of answers/time you may get from me or your TA will improve significantly through use of electronic means, scheduled meetings, and visits during office hours
4. We will occasionally broadcast news (e.g. hints for solution of HW) through electronic means.
5. We may require you to submit copies of your work/computer programs via electronic means.
6. I will start and the end the class at the scheduled time, late arrivals and early departures distract me and your cohorts are not considered proper professional conduct, except in cases of emergency.
7. No food is allowed during lecture and workshops.

Objectives of the Course

Upon completion of this course, you should be able to:

Understand how chemical products enhance our standard of living individually and collectively.

Discuss social (e.g. job) and economic (e.g. profit) impact of a chemical product, enterprise in the chemical business, and a chemical manufacturing facility on the various elements of the society and environment.

Produce a conceptual design that is economically and technically feasible in addition to satisfying one or more of the following constraints/objectives: environmental, safety, flexibility, reliability, operability, ethics, national security, controllability.

Estimate feasibility of a project, starting from material and energy balances, through equipment sizing, cost estimation, and profitability analysis.

Make the sound decision, faced with a set of alternatives, by employing the appropriate technical and economic feasibility criteria.

Make engineering assumptions.

Learn to make decisions when multiple, possibly conflicting, objectives (criteria) exist.

Learn to make decisions with limited available information.

Use computer aided design tools and sensitivity analysis effectively.

Analyze and evaluate information related to chemical plant and product design critically.

Schedule various synthesis and analysis techniques to solve process and product systems engineering problems effectively.

Communicate results of a major design project through a written report and professional presentation.

Work in a group productively

REFERENCES

(A subset of the List is placed in the library reserve)

See coverage from lecture outline

Popular Process and Product Design Texts

1. "Systematic Methods of Chemical Process Design" Biegler, Grossmann, Westerberg, Prentice Hall, 1997
2. "Conceptual Design of Chemical Processes", James M. Douglas, McGraw-Hill, 1988
3. "Strategy of process Engineering", Rudd and Watson, Wiley, 1968
4. "Plant Design and Economics for Chemical Engineers", Max S. Peters and Klaus D. Timmerhaus, McGraw-Hill, 5th Edition, 2003
5. "A Guide To Chemical Engineering Process Design And Economics", Gael Ulrich, Wiley, 1984
6. "Coulson and Richardson 's Chemical Engineering: Volume 6. Design: R.K. Sinnott, Towler 5th edition. B-H, 2009
7. "Analysis, Synthesis, and Design of Chemical Processes", Turton, Baillie, Whiting, Swaeiwitz, Prentice Hall, 2002, 2nd edition
8. "Product and Process Design Principles: Synthesis, analysis, and evaluation" Seider, Seader, Levin Wiley, 3rd edition, 2009
9. "Process Design and Engineering Practice", Woods, D.R., Prentice-Hall, 1995
10. "Engineering Design: A Materials and Processing Approach," Dieter, 3rd. Ed. McGraw Hill, 2000
11. "Chemical Process: Design and Integration" Smith, McGraw Hill, 2nd ed., 2005
12. Chemical Product Design by Cussler and Moggridge, Cambridge Press, 2nd ed, 2011

General References

- G1. “Kirk-Othmer Encyclopedia of Chemical Technology*” 5th edition; Wiley Inter-science, 2007
- G2. “Encyclopedia of Chemical Processing and Design*” McKetta ed., Marcel Decker, 1993
- G3. “Ullmann’s Encyclopedia of Industrial Chemistry*” 7th ed., Wiley, 2011
- G4. “Perry's Chemical Engineering Handbook”, 8th ed. Green and Perry(eds.) McGraw Hill, 2008
- G5. “Chemical Process Equipment Selection and Design”, Couper, Penney, Fair, Walas, Butterworth, 2005

The data sources for thermo-physical properties

- P1. “The Properties of Gases and Liquids” Poling, Prausnitz, O’Connell, McGraw-Hill 5th Edition, 2001.
- P2. “Vapor-Liquid Equilibrium Data Collection”, Gmehling, Onken, Arlt, Grenzeuser, DECHEMA, 1980* several volumes.

Chemical industry, chemical products, employment,

- C1. “The Chemical Process Industries Infrastructure” Couper, Beasley, and Penney, Marcel Dekker, 2001

* These multi-volume series are at the library reference section.

Specialized books/manuals

- S1. “Pollution Prevention for Chemical Processes” Allen and Rosselot, Wiley, 1997
- S2. “Handbook of Chemical Technology and Pollution Control”, Hocking, Academic Press, 1998
- S4. “Green Engineering” Allen and Shonnard, Prentice Hall, 2002
- S5. “Chemical Process Safety: Fundamentals with Applications”, Crowl and Louvar, Pearson Education- 2011 – 3rd Edition
- S6. “National Institute for Occupational Safety and Health, pocket guide to Chemical Hazards”, NIOSH, 1987

Important Online Sources

<http://www.aiche.org/>

<http://sache.org/index.asp>

<http://webbook.nist.gov/chemistry/>

http://www.epa.gov/nrmrl/std/cppb/war/sim_war.htm

TOPICAL OUTLINE OF THE LECTURES

- Lecture 1. Course outline
Jan 10th
- Lecture 2. Process Design Case Studies
Jan 12th
Workshop 1: Chemcad Tutorial
- Lecture 3. Q1: M&E Balances. Q2. CHE Thermo.
Jan 17th
- Lecture 4. Product Design. Product Design Case Studies
Jan 19th
Workshop 2: COMSOL
- Lecture 5. Q3. Reactors. Reactor Design: Reactor type and operating parameter selection
Jan 24rd
- Lecture 6. Reactor Design: Design and instrumentation of reactors
Jan 26th
Workshop 3: Reactor Design Workshop
- Lecture 7. Q4. Transport Phenomena. Environmental Impact Analysis and Green Engineering
Jan 31st
- Lecture 8. Waste Treatment
Feb 2nd
Workshop 4: WAR Algorithm. Environmental Impact Analysis
- Lecture 9. Q5. Mass transfer and Separation Processes: Separation Processes: Separation technology selection, Synthesis of separation systems
Feb 7th
- Lecture 10. Design and costing of Separation Units
Feb 9th
Workshop 5: Properties Estimation and Regression using Chemcad
- Lecture 11. Q6. Heat Transfer. Heat Transfer: Selection and Design of heat exchange media and operating conditions; Review of heat transfer coefficient relations;
Feb 14th
- Lecture 12. Heat Transfer: Synthesis of heat exchange networks
Feb 16th
Workshop 6: Heat Exchanger Networks, Pinch Method
- Lecture 13. Q7. Fluid Flow. Fluid Flow and Materials Handling Equipment Selection
Feb 21th

Lecture 14. Fluid Flow and Materials Handling Equipment Selection
Feb 23st
Workshop 7 : Chemcad Fluid Distribution System Design

Lecture 15. Q8. Environment and Safety; Risk assessment and Safety
Feb 28th

Lecture 16. Risk assessment and Safety
Mar 1st
Workshop 8 : Workshop Relief Systems

Lecture 17. Q9. Design Trouble Shooting
Mar 6th

Lecture 18. Report writing and technical presentations
Mar 8th
Workshop 9: Scheduling Problems

Lecture 19. Q10. Engineering Economics. Supply Chain Optimization
Mar 20th

Lecture 20. Linear Programming
Mar 22th
Workshop 10. Linear Programming

Design Presentations

April 17th, 19th lecture period and April 19th Workshop

Capstone Design Poster Day: Apr 27th

Final Exam
May 1st 7:30-9:30 AM

Project Milestones

Process Design Project	Product Design Project	Due Date
Process Flowsheet	Product Design Concepts	January 31th
Material and Energy Balances	Concept Selection	February 14th
Equipment Sizing	Product Design	February 28th
Economic Feasibility	Manufacturing and Economic Analysis	March 7th

Group Project Draft Due Date:	5 PM April 4th, 2011
Project reviews	April 10 and 12
Group Presentations:	April 17, 19
Final Electronic copy of report and presentation	April 20nd
Poster Presentations due	April 23
Project Poster Presentations:	April 27th

Project for Spring 2012

You are expected to produce a conceptual design that is economically and technically feasible in addition to satisfying the following constraints/objectives: environmental, safety, flexibility, reliability, operability, ethics, national security, controllability.

The requirements include: participation in the group activities and meetings, written group report, oral group presentation to a technical audience and poster presentation to a general audience.

The project areas:

- A Nutraceutical Products and Timed/Controlled Release Products**
- B. AIChE Contest problem**
- C. Energy Related Processes and Products**
- D Alcohol free beverage process/products**
- E. Biomedical and Biological**

Groups will be assigned.

Please fill this form and turn it in

Your Name:

Personality type

**The project areas I am interested in:
(List at most three in the order of preference)**

The three people I will like to work with:

The two people I will not like to work with: