

ChE Instructional Objective Survey

CH E 328

Chemical Reaction Kinetics

Instructor: Daniel L Shaffer

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Thank you for your assistance in improving our courses.

1 Ability to design isothermal reactors for homogeneous and heterogeneous systems.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

2 Ability to determine a rate law and reaction mechanism from laboratory rate data.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

3 Ability to analyze a catalytic mechanism and establish rate limiting step(s).

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

4 Ability to work as a team to achieve laboratory and research project goals.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

5 A basis for incorporating safety into any reactor design.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

ChE Instructional Objective Survey

CHE 215

Elementary Principles I

Instructor: Jim Duffy

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1 Able to convert quantities from one set of units to another quickly and accurately.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

2 Able to define and determine properties of process streams including fluid density, flow rate, chemical composition (mass and mole fractions, concentrations), fluid pressure, and temperature.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

3 Material balance calculations: Draw and label process flowcharts from verbal process descriptions. Carry out degree of freedom analyses (process bookkeeping).

Write and solve material balance equations for single-unit and multiple-unit processes, processes with recycle and bypass, and reactive processes.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

4 Applied physical chemistry: Perform pressure-volume-temperature calculations for ideal and non-ideal gases. Incorporate the results of these calculations into process material balance calculations.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

5 Applied physical chemistry: Perform vapor-liquid equilibrium calculations for systems containing one condensable component and for ideal multicomponent solutions. Incorporate the results of these calculations into process material balance calculations.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

6 Teamwork: Work effectively in problem-solving teams both in and out of class.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

ChE Instructional Objective Survey

CH E 424

Transport Analysis

Instructor: Joseph Seymour

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- 1 Students should understand the origins of transport phenomena in conservation laws and be able to formulate transport equations from the general conservation equation.

This includes the ability to write down in mathematical terms the diffusive, convective and generation terms for a given problem and grasp the meaning of each.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 2 The capacity to generate differential equations governing transport in physical systems will be developed.

This will include the use of order of magnitude analysis and non-dimensionalization methods to simplify equations in a systematic fashion. An understanding of dimensionless groups in a physical context will be promoted. Generation of differential equations will include understanding of boundary conditions in physical and mathematical terms.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 3 Students will develop knowledge of the molecular scale origin of transport coefficients and an awareness of the derivation of macroscopic scale transport coefficients, such as the Taylor-Aris dispersion coefficient.

Students will have the ability to identify the appropriate empirical transfer coefficients for heat and mass for given physical situations and understand their relations to dimensionless groups where appropriate. The skills necessary to calculate transport and transfer coefficients will be established.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 4 Students will gain competence in solving differential equations using numerical and analytical methods.

Numerical solution skills in MATHCAD will be developed in solving unsteady and steady state transport equations. Students should develop an understanding of the graphical forms of the solutions in the context of the physical process it describes, allowing for discussion of the solution shape and slope in terms of the process.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 5 Problem solving skills, which integrate the above objectives and prior student knowledge to set up and solve macroscopic heat and mass transport problems will be developed.

Students should be able to use both fundamental transport phenomena balances and transfer coefficient approaches to solve transport problems relevant to Chemical Engineering design and practice.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

ChE Instructional Objective Survey

CHE 213

Materials Science

Instructor: John Mandell

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- 1 The student should be able to grasp the fundamental materials based issues of importance to their particular discipline, and its evolution.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 2 The student should be comfortable with the problem solving techniques used in various branches of materials science, including processing, crystal structure, properties and performance in service, and interrelationships.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 3 The student should be able to deal with the basic aspects of materials issues in related fields as they impact that discipline.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 4 The student should be prepared to recognize aspects of engineering applications which might be improved by changes in the materials involved, particularly with regard to the substitution of new materials.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 5 The student should be able to make basic judgements as to appropriate types of materials for design considerations, and how to locate sources of more detailed information.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

ChE Instructional Objective Survey

CH E 322

Fluid Mechanics and Heat Transfer

Instructor: Ron Larsen

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1 Fluid Statics: Determine the pressure at the bottom of a column of fluid

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

2 Fluid Statics: Calculate the pressure difference across a manometer.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

3 Mechanical Energy Balance: Apply simplifications to the mechanical energy balance that are appropriate to a particular situation.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

4 Mechanical Energy Balance: Explain the difference between the energy "to the pump" and "to the fluid".

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

5 Mechanical Energy Balance: Solve the mechanical energy balance to determine the required pump size for a particular problem.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

6 Mechanical Energy Balance: Determine the required pump power using the results of the mechanical energy balance and the mass flow rate through the system.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

7 Fluid Friction: Determine friction factors and hfs values for laminar and turbulent flow problems in both smooth and rough pipes.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

8 Fluid Friction: Determine friction losses in valves and fittings.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

9 Compressible Flow: Relate reservoir and receiver pressure, temperature, and density for isentropic expansions

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

10 Compressible Flow: Calculate the acoustic velocity of an ideal gas at specified temperature and pressure.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

11 Compressible Flow: Calculate the maximum permissible length of an adiabatic or isothermal pipeline.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

12 Packed and Fluidized Beds: Calculate the sphericity of a non-spherical particle.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

13 Packed and Fluidized Beds: Understand the meaning of porosity, or void fraction.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

14 Packed and Fluidized Beds: Calculate the pressure drop across a packed bed using the Ergun equation.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

15 Packed and Fluidized Beds: Calculate the pressure drop across a fluidized bed at minimum fluidization.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

16 Pumps: Explain the difference between a positive displacement pump and a centrifugal pump.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

17 Pumps: Read a centrifugal pump curve to identify the operating point, best efficiency point, end of curve horsepower, and required trim.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

18 Pumps: Explain why the net positive suction head (NPSH) must be checked to avoid cavitation.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

19 Heat Transfer: Explain the differences between conduction, convection, and radiation heat transfer.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

20 Heat Transfer: Solve for the temperature profile in a conductive medium (e.g., metal rod) with constant temperature boundary conditions.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

21 Heat Transfer: Calculate an overall heat transfer coefficient from individual heat transfer coefficients.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

22 Heat Transfer: Estimate wall temperatures based on an analysis of major resistance to heat transfer in a system.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

23 Heat Transfer: Select the appropriate equation to determine individual heat transfer coefficients for laminar or turbulent flows in various geometries.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

24 Heat Transfer: Calculate the rate at which energy can move across the tube wall(s) in a heat exchanger using the overall heat transfer coefficient, area available for heat exchange, and temperature driving force.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

25 Heat Transfer: Calculate a corrected log mean temperature difference for a multi-pass heat exchanger using FG charts.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

ChE Instructional Objective Survey

CHE 251 V

Societal Impacts of Chemical Engineering

Instructor: Phil Stewart

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1 Ability to prepare and deliver effective informative presentations.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

2 Ability to prepare effective visual aids for oral presentations.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

3 Ability to prepare and deliver effective persuasive presentations.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

4 Ability to identify principles from the AIChE Code of Ethics.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

5 Ability to apply ethical principles to the analysis of specific professional situations.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

6 Ability to explain how chemical engineering technologies affect people and the environment.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

ChE Instructional Objective Survey

CH E 323

Mass Transfer Operations

Instructor: Duffy

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1 Describe the various separation processes available to chemical engineers and formulate an appropriate separation strategy for a process stream based on composition, physical properties, and design heuristics.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

2 Analyze a steady state mass transfer situation, determine or derive the appropriate mass transfer equation, and solve the resulting expression.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

9 Evaluate and solve design problems involving the following unit operations: Flash vaporization.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

10 Utilize ChemCAD to design simple distillation systems and analyze the program output for the effects of design parameter variability.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

11 Work effectively on problem solving teams.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

8 Evaluate and solve design problems involving the following unit operations: Partial vaporization/condensation.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

7 Evaluate and solve design problems involving the following unit operations: Liquid extraction.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

6 Evaluate and solve design problems involving the following unit operations: Binary distillation.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

5 Evaluate and solve design problems involving the following unit operations: Multicomponent distillation.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

4 Evaluate and solve design problems involving the following unit operations: Gas absorption and stripping.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

3 Evaluate and solve design problems involving the following unit operations: Membranes.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

ChE Instructional Objective Survey

CH E 100

Freshman Seminar

Instructor: Seymour

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- 1 Students experience the variety of topics and disciplines within chemical engineering through classroom discussion, demonstrations and group exercises, and guest lectures by Chemical Engineering Faculty

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 2 Students are introduced to problem solving strategies, engineering design considerations, and library research skills.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 3 Students' required attendance and participation in group exercises and discussions foster teamwork and collegiality among incoming students.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

ChE Instructional Objective Survey

CHE 215

Elementary Principles I

Instructor: Deibert

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1 Convert variable values between the major systems of units and between different dimensional units within each system.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

2 Identify and label the units of each variable and value used in a problem solution.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

3 Express answers in appropriate units and with a reasonable number of significant figures based on the information provided in problem statements.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

4 Determine orderly approaches to solving simple, single unit, material balance problems (using in = out).

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

5 Calculate accurate answers to problems by implementing these orderly approaches.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

6 Calculate accurate answers to material balance problems for processes that include several interconnected operations, some with recycle or bypass streams.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

7 Solve material balance problems on processes which include chemical reactions using either the extent(s) of reaction(s) or the elemental balance approach (using in + generated = out + consumed).

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

8 Be able to identify the problems for which the extent of reaction approach is preferable to the elemental balance approach, and vice versa.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

9 Calculate accurate answers to problems involving chemical reaction using the definitions of limiting reactant, excess reactant, fractional excess, fractional conversion, yield and selectivity in the problem definitions and/or solution requirements.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

10 Solve material balance problems on processes which include fuel combustion reactions using the definitions of theoretical air (oxygen) and excess air (oxygen).

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

11 Calculate answers to combustion material balance problems for which product gas compositions are presented on a dry basis.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

12 Solve problems that relate the volumes, specific gravities, masses, and moles of liquids and solids.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

13 Describe the ideal gas law and use it to solve problems that relate the pressure, temperature, volume, and moles of an ideal gas.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

14 Identify situations in which the ideal gas law works well and those for which the use of a non-ideal gas correlation is necessary.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

15 Describe the law of corresponding states, and identify the basis for the determination of a material's critical temperature and critical pressure.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

16 Calculate the reduced temperature, reduced pressure and ideal reduced volume of a gas.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

17 Solve problems involving non-ideal gasses using the generalized compressibility charts to relate reduced temperature, reduced pressure, ideal reduced volume and compressibility factor.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

18 Describe the concept of the equilibrium vapor pressure of liquids and solids and the method of measuring the temperature dependent vapor pressure of a material.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

19 Calculate from standard mathematical correlations and/or be able to use tables to establish the vapor pressure a pure liquid as a function of its temperature.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

20 Explain the concept of a saturated mixture of a non-condensable gas and a condensable vapor. Describe relative saturation (humidity) of vapor –gas mixtures.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

21 Solve material balance problems in which one or more component is condensed or vaporized in the process.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

22 Be able combine all of the concepts presented in the course to identify efficient solution methods and be able to implement those methods to determine answers to complex material balance problems.

This objective has been met.

strongly
disagree

somewhat
disagree

somewhat
agree

strongly
agree

ChE Instructional Objective Survey

CH E 216

Elementary Principles II

Instructor: Deibert

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- 1 List and define in your own words the three components of the total energy of a process system and the two modes of energy transfer between a system and its surroundings. State the conditions under which energy transfer by heat and by work are positive.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 2 Convert an energy or power (energy/time) expressed in any unit (e.g., J, dyne.cm, Btu, ft.lbf/h, kW, hp) to its equivalent in any other dimensionally consistent units.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 3 Calculate the kinetic energy of a body of mass m moving with velocity u or the rate of transport of kinetic energy by a stream moving with mass flow rate m and velocity u .

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 4 Calculate the potential energy of a body of mass m at elevation z or the rate of transport of potential energy by a stream moving with mass flow rate m at elevation z , where z is a reference plane at which potential energy is defined to equal zero.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 5 Define the terms closed process system, open process system, isothermal process, and adiabatic process

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 6 Write the first law of thermodynamics (the energy balance equation) for a closed process system and state the conditions under which each of the five terms in the balance can be neglected.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 7 Given a description of a closed process system, simplify the energy balance and solve it for whichever term is not specified in the process description.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 8 Define the terms flow work, shaft work, specific internal energy, specific volume, and specific enthalpy.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

9 Write the energy balance for an open process system in terms of enthalpy and shaft work and state the conditions under which each of the five terms can be neglected.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

10 Given a description of an open process system, simplify the energy balance and solve it for whichever term is not specified in the process description.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

11 State why the actual values of U and H can never be known for a given species in a specified state (temperature, pressure, and phase) and define the concept of a reference state.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

12 Explain why the reference state used to generate a table of specific internal energies or enthalpies is irrelevant if one is only interested in calculating ΔU or ΔH for a process.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

13 Given a process in which a specified mass m of a species goes from one state to another and tabulated values of U or H for the species at the initial and final states are available, calculate ΔU or ΔH .

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

14 Given values of V at each state, calculate ΔH from the previously calculated ΔU or vice versa. Carry out the corresponding calculations to determine ΔU or ΔH for a stream with mass flow rate m going from one state to another.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

15 Use the saturated and superheated steam tables to determine describe properties of the liquid and vapor phases.

(a) Whether water at a specified temperature and pressure is subcooled liquid, saturated liquid, saturated vapor, or superheated vapor;

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

16 Explain the significance of the specific internal energy values and enthalpy values tabulated in the steam tables, use the steam tables to calculate ΔU (or Δu) and/or ΔH (or Δh) for a given process where water changes .

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

17 Given a description of a nonreactive process, draw and completely label a flowchart, including Q and W if their values are either specified or called for in a problem statement; perform a degree-of-freedom analysis and write equations to find all variables.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

18 Define both formally (in terms of internal energies and enthalpies) and in words a high school senior could understand the variables $C_v(T)$, $C_p(T)$, ΔH_v , and ΔH_s

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 19 Calculate ΔU and ΔH for the following changes in state of a species: Isothermal changes in pressure, Isothermal changes in pressure, isothermal isobaric phase changes and Isothermal isobaric mixing of two or more species.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 20 Know when the formulas you use for ΔU and ΔH calculations are exact, good approximations, and poor approximations.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 21 Given a reference state and a process state for a species, choose a path from the reference state to the process state consisting of a series of isothermal pressure changes, isobaric temperature changes, and isothermal isobaric phase changes.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 22 Derive $\Delta U = mC_p\Delta T$ (listing assumptions) from the closed system energy balance ($Q + W = \Delta U + \Delta k + \Delta ep$).

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 23 Estimate the heat capacity of a liquid or solid species using Kopp's rule. Estimate the energy of fusion and energy of vaporization of a species using correlations in Section 8.4b.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 24 Given any nonreactive process: Draw and label the flowchart, including Q in labeling; carry out a degree-of-freedom analysis; write material & energy balances and other equations, perform the calculations, listing the assumptions and approximations.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 25 Given an adiabatic process or any other nonreactive process for which the value of Q (closed system) or Q (open system) is specified, write material and energy balance equations and solve them simultaneously for requested quantities.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 26 Explain the meaning of the apparently contradictory term adiabatic cooling. Explain how spray cooling and humidification, spray dehumidification, and spray drying work. Explain how it is possible to dehumidify air by spraying water into it.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 27 Explain to a first-year engineering student why a beaker containing acid gets hot if you add water to it.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 28 Use energy of solution data and solution heat capacity data to: calculate the enthalpy of a hydrochloric acid, sulfuric acid, or sodium hydroxide solution of a known composition (solute mole fraction) relative to the pure solute and water at 25°C

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 29 Use energy of solution data and solution heat capacity data to: Calculate the required rate of energy transfer by heat to or from a process in which an aqueous solution is formed, diluted, or combined with another solution of the same species.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 30 Use energy of solution data and solution heat capacity data to: Calculate the final temperature if an aqueous solution of HCl, H₂SO₄, or NaOH is formed, diluted, or combined with another solution of the same species adiabatically.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 31 Perform material and energy balance calculations for a process that involves solutions for which enthalpy-concentration charts are available.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 32 Explain in your own words the concepts of heat of reaction, exothermic and endothermic reactions, heat of formation, combustion, heat of combustion; standard heats of formation, combustion, and reaction; heating value and adiabatic flame temperature.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 33 Calculate the total enthalpy change given 1) The amount of any reactant consumed or any product generated in a reaction at a given temperature and pressure; and 2) The heat of the reaction at that temperature and pressure.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 34 Determine a heat of reaction from heats of other reactions using Hess's law. Determine standard enthalpies and internal energies of reaction from known standard heats of formation and heats of combustion.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 35 Write and solve an energy balance on a chemical reactor using either the heat of reaction method or the heat of formation method, specify which method is preferable for a given process. Write the process path implicitly adopted when each method is used.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 36 Solve reactive-system energy balance problems for the heat transfer required for specified inlet and outlet conditions, outlet temperature corresponding to a specified heat input, product composition corresponding to a specific heat input and output temp.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 37 Solve energy balance problems for processes involving solutions for which heats of solution are significant.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 38 Convert a higher heating value of a fuel to a lower heating value and vice versa.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

ChE Instructional Objective Survey

CHE 216

Elementary Principles II

Instructor: Duffy

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Thank you for your assistance in improving our courses.

1 Basic engineering calculations. Convert quantities from one set of units to another quickly and accurately.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

2 Basic engineering calculations. Define and determine or estimate properties of process streams including fluid density, flow rate, chemical composition, pressure, temperature, enthalpy, internal energy, kinetic energy, potential energy, and flow work.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

3 Draw and label process flowcharts from verbal process descriptions. Write and solve material and energy balance equations for single-unit and multiple-unit processes, processes with recycle and bypass, and reactive processes.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

4 Perform pressure-volume-temperature calculations for ideal and non-ideal gases. Incorporate the results of these calculations into process material and energy balance calculations.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

5 Perform vapor-liquid equilibrium calculations for systems containing one condensable component and for ideal multicomponent solutions. Incorporate the results of these calculations into process material and energy balance calculations.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

6 Calculate internal energy and enthalpy changes for process fluids undergoing specified changes in temperature, pressure, phase, and chemical composition. Incorporate the results of these calculations into process material and energy balance calculations.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

7 Work effectively in problem-solving teams.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

ChE Instructional Objective Survey

CH E 220

Computations in Chemical Engineering

Instructor: Larsen

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Thank you for your assistance in improving our courses.

-
- 1 Basics: Students will gain a high degree of proficiency using Excel for standard mathematical operations (cell arithmetic), built-in functions, and graphing XY-scatter plots.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 2 Regression: Students will be able to add various types of trend lines (linear, polynomial, etc.) to a graph they have created, and have Excel display the equation of the line and, when appropriate, the R2 value of the fit curve.

Students will know that Excel provides a Regression Analysis Package that is available if there is no suitable trend-line for a particular application.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 3 Statistics: Students will understand the meaning of terms such as normal distribution, population, sample, error, and deviation.

Students will be familiar with and able to use Excel's built-in functions for basic statistical operations such as calculating an average, standard deviation, or variance for either a sample or a population. Students will be able to compute the confidence interval about a mean value (normal distribution), and understand the meaning of the result.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 4 Time Value of Money: Students will understand how interest rates create a time value of money, and why interest rates must be considered as amounts of money are moved through time.

Students will be able to use Excel's time value of money functions to move amounts through time (FV, PV, PMT). Students will be able to use Excel's time value of money functions to compare alternatives. Students will be able to use Excel functions to compute an internal rate of return for a series of incomes and expenses, and understand the meaning of the result.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 5 Matrix Math: Students will know the standard matrix math operations, and how to accomplish them in Excel.

Students will understand how to use Excel's "array" functions, why there are special procedures for entering array functions, and the benefit array functions provide the user. Students will be able to solve systems of linear equations using Excel's matrix mat functions.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

6 Solving One Ordinary Differential Equation: Students will learn to use Euler's method to create an arithmetic approximation of an ODE.

Students will learn about stability and accuracy (or lack thereof) associated with using Euler's method to find approximate solutions to ODEs.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

7 Basics: Students will learn how to enter equations in Mathcad, how to control the order in which equations are solved, and how to control the presentation of results.

Students will understand how Mathcad handles units, and the types of unit conversions that are not possible in Mathcad.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

8 Functions: Students will learn how to use Mathcad's built-in functions. Students will learn how to write their own functions in Mathcad.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

9 Matrix Math: Students will know the standard matrix math operations, and how to accomplish them in Mathcad.

Students will be able to solve systems of linear equations using Mathcad.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

10 Graphing, Curve-Fitting, Interpolation: Students will learn how to create a multi-curve plot in Mathcad. Students will learn to use Mathcad's spline fit and interpolation functions.

Students will be able to look at a graphed data set and recognize when regression is more appropriate than spline fitting.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

11 Iterative Solutions: Students will be able to set up a solve block to solve iterative problems using Mathcad.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

12 Numerical Differentiation: Students will understand how finite difference approximations are derived for common first and second order derivatives.

Students will recognize the difference between forward, backward, and central first-order finite differences. Students will be able to use finite differences to compute estimates of derivatives from data sets.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

13 Numerical Integration: Students will understand the relationship between the area beneath a curve and the integral of the function represented by the curve.

Students will write a trapezoidal integration function and be able to use that function to compute the area beneath a curve.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

14 Solving One Ordinary Differential Equation: Students will learn to use Mathcad's rkfixed function to solve a single ordinary differential equation using fourth order Runge-Kutta methods.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

15 Solving Simultaneous Ordinary Differential Equations: Students will learn to rewrite higher order differential equations as systems of first-order differential equations.

Students will learn to use Mathcad's rkfixed function to solve a system of single ordinary differential equations using fourth order Runge-Kutta methods.

This objective has been met. strongly
disagree ----- somewhat ----- somewhat ----- strongly
disagree disagree agree agree

16 Solving One Partial Differential Equation: Students will learn to use the Method of Lines to transform one partial differential equation into a series of first-order ordinary differential equations.

Students will recognize that a partial differential equation cannot be solved unless sufficient boundary and/or initial conditions are known. Students will be able to solve a series of ordinary differential equations using Mathcad's rkfixed function.

This objective has been met. strongly
disagree ----- somewhat ----- somewhat ----- strongly
disagree disagree agree agree

17 Programming: Students will learn the fundamental operations of all programming languages: Data, Input, Operations, Output, Conditional Execution, Loops, Functions

Students will learn typical flowchart symbols, and be able to read and understand simple programming flowcharts.

This objective has been met. strongly
disagree ----- somewhat ----- somewhat ----- strongly
disagree disagree agree agree

ChE Instructional Objective Survey

CHE 307

Chemical Equilibrium

Instructor: Sears

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Thank you for your assistance in improving our courses.

- 1 State the first and second laws of thermodynamics in words or equation form. Recite the microscopic and macroscopic views of entropy in words or equation form.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 2 Use thermodynamic tables to determine thermodynamic values such as enthalpy or entropy, given sufficient values of thermodynamic state variables.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 3 Use heat capacity relations to calculate the change in enthalpy or entropy of a fluid or solid, given the change in temperature, pressure or relative change to the standard state of the component.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 4 Use the first law of thermodynamics and the enthalpy or internal energy of a fluid(s) to calculate the energy balance; i.e. work, or enthalpy state of a stream in a process system.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 5 Use the laws of thermodynamics and entropy in a process analysis to calculate the efficiency of a process or the work given the efficiency.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 6 Know how to find the derivative relations of thermodynamics.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 7 Use an equation of state to calculate the true T-P-density conditions for a fluid and use a departure function to calculate the true enthalpy of a fluid, given the specified equation or function.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 8 State the definition of fugacity and be able to calculate the fugacity of a fluid or solid using a specified method of thermodynamics.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

9 State the criteria for phase equilibrium in terms of fugacity, temperature and pressure in word or equation form.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

10 Specify the degrees of freedom in a system, given the components and some thermodynamic state properties.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

11 State the definition of a distribution coefficient in word or equation form.

Use it in conjunction with fugacity coefficients, Raoult's Law and Henry's Law to find the distribution coefficient for a component between two phases for a system.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

12 Use fugacity relations and the determination of equilibrium from equations of state (theory and associated numerical software) to calculate equilibrium in pure component and multi-component systems.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

13 State the definition of an activity coefficient and the Gibbs-Duhem equation and solution models; use a chemical engineering software package to calculate the composition in equilibrium.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

14 Interpret a phase equilibrium diagram and use it to obtain compositions and intensive variable thermodynamic functions.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

15 State the criteria for chemical equilibrium; calculate the reaction equilibrium composition for a single reaction, in a single phase and in multiple phases.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

16 Calculate the reaction equilibrium composition for more than one reaction in a single phase. Calculate multiple equilibrium compositions, using available software packages or algebraic relations from material balances and chemical equilibrium

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

17 Calculate the change in the chemical equilibrium constant from standard state, using van't Hoff's Law; and, at a given temperature if given a chemical composition, or from the chemical engineering software.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

18 Be able to solve an engineering problem by combining at least two of these objectives.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

19 Perform an energy balance on a reacting, equilibrium system to find an outlet condition of a process system.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

ChE Instructional Objective Survey

CH E 338

Bioprocesses in Engineering

Instructor: Pasmore

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Thank you for your assistance in improving our courses.

1 Students will demonstrate a knowledge of basic cellular biology.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

2 Students will discuss of the current areas where biology is used in engineering.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

3 Students will design the control biological processes.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

4 Students will predict and calculate the energetics of biological reactions.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

5 Students develop an understanding of the current literature on a biologic process that they are interested in.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

6 Students will critique literature and develop an understanding not all literature is "good" and aid in distinguishing "good" from "bad".

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

7 Students will develop/improve technical writing skills, in the format of a review article.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

8 Students will know the basic processes involved in wound healing and immune response

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

9 Students will understand the basic aspects and concerns in tissue engineering.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

ChE Instructional Objective Survey

CH E 400

Professionalism in Chemical and Biological Engineering

Instructor: Larsen

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Thank you for your assistance in improving our courses.

- 1 Students explore post-graduation career paths (including graduate school and/or professional engineer registration) in light of their own career goals and interests.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 2 Students recognize the ethical and professional responsibilities of an engineer in the workplace and in the larger community, including an understanding of the impacts of engineering decisions on globally significant issues.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 3 Students understand the Professional Registration Process and its undertaking as part of ongoing educational process of career enhancement and advancement.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

ChE Instructional Objective Survey

CH E 402

Chemical and Petroleum Industries

Instructor: Sears

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1 Identify and discuss which type of diagram (BFD, PFD, P&ID, or 3-D layout) is appropriate to use for a given application.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

2 Given a flow diagram, identify heuristics/factors which might have been used in developing the process scheme.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

3 Given a flow sheet and flowrates, be able to calculate Single-Pass Conversion, Overall Conversion, and/or Yield.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

4 Calculate the Bare Module equipment cost of an item.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

5 Given a flow sheet or unit operation, estimate the operating cost and operating labor required.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

6 Estimate the operating costs of a process given flows, total F.C.I. And %R & D, And Administrative, Distribution and Patent costs.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

7 Calculate Annual Net Profit of a process given flows, total F.C.I. And %R & D, And Administrative, Distribution and Patent, and material and product costs.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

8 Calculate the NVP given a cash flow diagram.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

9 Choose the best of two investment alternatives based on the NPV.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

10 Determine the ROROI (average) or DCFROR for a simple process with straight line depreciation.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

12 Specify why the ammonia synthesis uses a particular operation.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

13 Given a process flowsheet, identify 1) purpose of a given operation, 2) why a material of construction for unit and given T & P are used.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

14 For a given hydrocracking process and product mix, identify 1) why short or long exposure times were chosen, and 2) why direct-fired or indirect heaters were chosen in design.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

15 Determine potential sites for a chemical facility using the relationships between raw materials, intermediates and final products.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

16 Describe in detail the design rationale for the unit operations examined on the field inspection trip.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

17 Discuss design and operation of materials, petroleum, environmental, chemical and/or biochemical processes; and, perform an economic analysis of portion of one particular process.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

18 Discuss current management and economic issues and trends in chemical industry, as well as, current structural interaction of companies.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

11 Perform a calculation of a total grass-roots capital investment, given Bare Module equipment costs.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

ChE Instructional Objective Survey

CHE 411 C

Design of Chemical and Petroleum Processes I

Instructor: Shaffer

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Thank you for your assistance in improving our courses.

1 Ability to undertake and succeed in the open-ended design of a chemical process plant.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

2 Ability to assemble a logical and practical sequence of integrated unit operations for a safe and workable chemical process operation.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

3 Ability to design process plant hardware.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

4 Ability to work as an effective team member.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

5 Ability to prepare and present written and oral technical reports.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

ChE Instructional Objective Survey

CHE 412 C

Design of Chemical and Petroleum Processes II

Instructor: Shaffer

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1 Ability to complete the open-ended design of a chemical process plant.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

2 Ability to use cash flow and time value of money concepts to determine the profitability of a process plant.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

3 Ability to work as an effective team member.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

4 Ability to prepare and present written and oral reports.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

ChE Instructional Objective Survey

CHE 415

Design Case Studies

Instructor: Deibert

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Thank you for your assistance in improving our courses.

- 1 Create process simulations using ChemCad and use these simulations to model the design and operating characteristic of a broad spectrum of physical and chemical processes.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 2 Explain the advantages of using process simulation programs to model and design chemical process, and the ways that these programs can readily be misused.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 3 Design integrated sequences of unit operations into processes that substantially comply with reasonable process constraints and efficiently achieve design objectives.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 4 Efficiently design and simulate integrated processes involving interconnected unit operations.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 5 Classify independent and dependent process design variables and explain why an engineer must understand the differences and relationships between these two design variable classes in order to develop viable unit operation and process designs.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 6 Identify the impact of thermodynamics on the design and operating characteristics of simulated and real physical and chemical processes and the means of incorporating appropriate thermodynamic models and correlations in ChemCad process simulations.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 7 Solve phase equilibrium (especially for multi-component vapor-liquid systems) problems for ideal and non-ideal systems using ChemCad unit operations and appropriate thermodynamic models.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 8 Directly incorporate phase equilibrium data into a simulation without using a thermodynamic model to estimate phase behavior.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

9 Design unit operations using reasonable values for design parameters (such as heat transfer coefficients in heat exchangers).

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

10 Create process simulations in which the unit operations are fixed in size (e.g., heat exchange area and heat transfer coefficient) rather than fixed in task (e.g., specification of output conditions for the fluids passing through a heat exchanger).

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

11 Design staged contacting unit operations (distillation and extraction towers) using ChemCad. Incorporate concepts of energy and economic efficiency in the design specifications of these units.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

12 Design a pressure-swing distillation system

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

13 Design an emission control system for VOC's dissolved in water.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

14 Design a pipe insulation system.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

15 Simulate chemical reactors with equilibrium, kinetic and fractional conversion constraints.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

16 Simulate the time-dependent behavior of transient processes.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

17 Develop simulations to model process upset (pre-accident) conditions with the objective of discovering possible causes for the upset.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

18 Design a re-circulating cooling water supply system.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

19 Design processes that involve ionic solutions and reactions (e.g., acid-gas absorption in a caustic solution).

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

20 Analyze the adequacy of a pre-simulated process to: 1) represent a reasonable response to the process design objectives; and, 2) Incorporate diligent design practice.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

ChE Instructional Objective Survey

CH E 438

Bioprocess Engineering

Instructor: Stewart

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Thank you for your assistance in improving our courses.

1 List several examples of biochemical products and outline their manufacture and uses.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

2 Analyze enzyme and microbial growth kinetics using models describing the rate dependence on substrate, inhibitor, and product concentrations.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

3 Calculate reaction-diffusion phenomena as they apply to immobilized enzyme and immobilized cell systems and discuss the tradeoffs in immobilized catalyst designs.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

4 Describe the features of reactor designs commonly used for bioprocesses and apply material balances and mass transfer models to analyze the operation of such bioreactors.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

5 Develop (or critique proposed) unit operation trains for the production and purification of biochemical products.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

6 Explain the advantages and differences of plant and animal cell culture compared to microbial systems.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

7 Describe different types of controlled release devices and apply quantitative models of their behavior.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

ChE Instructional Objective Survey

CH E 441

CH E Laboratory

Instructor: Sears, Seymour, Yurt

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Thank you for your assistance in improving our courses.

1 Identify an experimental objective.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

2 Develop and implement an experimental plan.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

5 Analyze data for statistical significance.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

6 Draw conclusions from experimental data.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

4 Operate laboratory equipment to meet an experimental objective.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

3 Independently investigate the relevant theory and background information for your proposed experiment.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

7 Communicate technical information verbally and in written documents (i.e. an abstract, written report)

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

ChE Instructional Objective Survey

CH E 444

Hazardous Waste Management

Instructor: Shaffer

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Thank you for your assistance in improving our courses.

1 Ability to recognize and assess the risks of a hazardous waste site.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

2 Ability to determine which environmental laws and regulations apply at a particular hazardous waste site.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

3 Ability to appreciate the interaction of politics, economics, technology, and social factors in dealing with a hazardous waste issue.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

4 An enhanced sense of the ethics and environmental justice elements of a hazardous waste management issue.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

ChE Instructional Objective Survey

CE 445

Hazardous Waste Treatment

Instructor: King

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Thank you for your assistance in improving our courses.

- 3 Understand how the chemical structure of a hazardous waste compound influences its physical and chemical properties (i.e. solubility, volatility, hydrophobicity, bioaccumulation).

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 4 Use empirical measures and/or experimental data of a hazardous waste compound solubility, Henry's constant, bioconcentration factor, partitioning constants (K_{ow} , K_f , K_d , K_{om}) to predict and quantify partitioning in the environment.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 5 Use empirical measures and/or experimental data of a hazardous waste compound solubility, Henry's constant, bioconcentration factor, partitioning constants (K_{ow} , K_f , K_d , K_{om}) to select appropriate remediation technologies.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 6 Understand and apply the basic principles of groundwater and contaminant transport to quantitatively predict exposure levels and pathways; and, to design containment and treatment methods for contaminated groundwater, LNAPL and DNAPL in the subsurface.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 7 Combine underlying scientific principles with engineering design criteria, mathematics and/or environmental engineering software to design effective removal of HW from of industrial waste streams or contaminated media.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 8 Use classical chemico-physical unit operations and biological reactors as components in a remedial design strategy.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

- 9 Use technologies for "permanent" disposal of hazardous wastes; as well as, methods of waste recovery, reduction and prevention.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

2 From the perspectives of various stakeholders, discuss the trade-offs between exposure risk and economics associated with containment vs. remediation strategies as part of the process of remedial alternative development and analysis.

This objective has been met. strongly
disagree ----- somewhat ----- somewhat ----- strongly
disagree disagree agree agree

1 Understand the health and environmental risks associated with exposure to uncontrolled hazardous wastes through a social/historical review of HW regulations and case histories.

This objective has been met. strongly
disagree ----- somewhat ----- somewhat ----- strongly
disagree disagree agree agree

10 Propose, design and present a Hazardous Waste Treatment/Remediation plan (and all design considerations) for a waste stream or a remediation site; developing a list of alternatives and defending the final selected technologies.

This objective has been met. strongly
disagree ----- somewhat ----- somewhat ----- strongly
disagree disagree agree agree

ChE Instructional Objective Survey

CH E 451

Process Dynamics and Control

Instructor: Larsen

The instructors in Chemical Engineering have defined instructional objectives for their courses. We are asking for your help to determine how well these objectives are being met by completing this survey. We will use this information to continuously improve our course offerings.

The instructional objectives for this course are listed below. On the scale below each objective, please indicate the extent of your agreement or disagreement with the statement: "This objective has been met."

Generally, instructors will provide an opportunity to complete this survey in class. A student will be asked to collect these surveys and return them to the Chemical Engineering Office, 306 Cobleigh Hall. If you want additional time to consider your responses, please return your survey to Shelley Thomas in the CHE Office before the end of finals week.

Thank you for your assistance in improving our courses.

1 Understand the function of P, I, and D actions in PID control, know when to use I and D and when not to.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

2 For PID control, be able to tune a process "tight" using on-the-fly tuning rules, know when not to tune a process "tight".

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

3 For PID control, be able to calculate initial tuning constants from process step response data.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

4 Understand advanced PID controls such as ratio, cascade, and logic control.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

5 Be able to develop a simple dynamic process model and solve it.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

6 Know the process control standard forms for 1st and 2nd order differential equations; and, understand that combining 1st order processes results in 2nd or higher order responses.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

7 Be able to write a order differential equation describing a first order process, including coefficient values, from step response data.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

8 Know what a transfer function is, and for what they are used.

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

9 Be able to take the laplace transform of a process model (differential equation).

This objective has been met. strongly disagree somewhat disagree somewhat agree strongly agree

10 Write a transfer function for each common element of a controlled process, and, be able to write down the combined transfer function for a controlled process responding to a change in set point or load.

This objective has been met. strongly
disagree ----- somewhat ----- somewhat ----- strongly
disagree disagree agree agree

11 Be able to determine the characteristic equation from a process transfer function.

This objective has been met. strongly
disagree ----- somewhat ----- somewhat ----- strongly
disagree disagree agree agree

12 Understand the meaning and usage of the terms poles and zeroes.

This objective has been met. strongly
disagree ----- somewhat ----- somewhat ----- strongly
disagree disagree agree agree

13 Be able to solve for the roots of a characteristic equation with appropriate math software.

This objective has been met. strongly
disagree ----- somewhat ----- somewhat ----- strongly
disagree disagree agree agree

14 Recognize that there are other types of control than just PID, such as, Dynamic Matrix Control.

This objective has been met. strongly
disagree ----- somewhat ----- somewhat ----- strongly
disagree disagree agree agree

15 Understand that DMC is model-based.

This objective has been met. strongly
disagree ----- somewhat ----- somewhat ----- strongly
disagree disagree agree agree

16 Know that DMC can be used to control the setpoints on PID controllers to achieve plant-wide optimization.

This objective has been met. strongly
disagree ----- somewhat ----- somewhat ----- strongly
disagree disagree agree agree