



Chemical Engineering[#] Table I: Criteria a-k and Evaluation Methods

UArizona Chemical Engineering Response

Criteria	Course	Measure	Timeline	Faculty	% Students Meeting Criteria
Criterion A – An ability to apply knowledge of mathematics, science, and engineering.	201L	Students used VBA integrated with Excel data manipulation to order, organize, and compile GHG emissions from UA flights for work.	Fall 2015	Blowers	100%
	203	Attendance and assignments were tracked to follow student understanding of using math, science, and engineering to solve heat transfer and fluid flow problems.	Spring 2016	Sorooshian	> 90
	303	Exam and Quiz	Fall 2015	Philipossian	82%
	401A	The students gave formulated analyses of reactor lab and reported results in a clear and concise manner.	Fall 2015	Gervasio	> 90%
	402	Test 3	Fall 2015	Saez	75%
	420	Attendance and assignments were tracked during the entire course that involved applying math, science, and engineering to design and analyze basic chemical reactors that contain both homogeneous and heterogeneous reactions. (Any homework or exam problem.)	Fall 2015	Sorooshian	> 90%
	477R	Passage (>60% correct) on four quantitative home works HW7 Stoichiometry; HW8 Bioenergetics part 1; HW9 Bioenergetics part 2; HW12 Kinetics Average passage of these four homeworks is 84.3% of students	Fall 2015	Field	84.30%
Criterion B – An ability to design and conduct experiments as well as to analyze and interpret data	301A	Group memo on heat transfer in shell-and-tube and plate-and-frame heat exchangers	Fall 2015	Kiehlbaugh	100%
	301B	Group report on the distillation of an ethanol/water mixture	Spring 2016	Kiehlbaugh	100%
	401A	Students in teams of 4 effectively designed paper project for "design a lab" presentations, presented experimental setups, expected results and error analyses	Fall 2015	Gervasio	> 90%
	413	ChEE 413 lab: Calibrate pressure sensor for process control system.	Spring 2016	Muscat	100%
	420	Various homework problems requiring students to interpret kinetic reaction data, and to think critically about the experimental design.	Fall 2015	Sorooshian	> 90%
Criterion C – An ability to design a system, component, or process to meet needs within realistic constraints	401A	Students effectively designed paper project for "design a lab" presentations; assessed factor such as cost, health and safety manufacturability, environmental impact and documented details in an associated report.	Fall 2015	Gervasio	> 90%
	413	ChEE 413 lab: Build a PID control algorithm in Matlab and use it along with the Arduino Uno, Arduino motor shield, valve, motor, and pressure sensor in a feedback loop to control the volume of water in a tank.	Spring 2016	Muscat	100%
	442	Final Project Report	Fall 2015	Schrader	>95%
	443	Final report	Spring 2016	Ogden	100%

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Criterion D – An ability to function on multidisciplinary teams	201L	Peer evaluation scores at end of semester for ability to function in teams.	Fall 2015	Blowers	93.90%
	301B	Team memo on steady-state heat transfer in extended surfaces experiment	Spring 2016	Kiehlbaugh	100%
	326	Students give small group presentations on new topics and then peer evaluate each other on how well each student served the team.	Spring 2016	Blowers	96%
	401A	Successfully worked in teams of 4 in lab and finished lab reports on time in a professional manner	Fall 2015	Gervasio	> 90%
	443	Final report and mid semester evaluation	Spring 2016	Ogden	95%
Criterion E – An ability to identify, formulate, and solve engineering problems	203	Students solved heat transfer and fluid flow problems	Spring 2016	Sorooshian	> 90%
	303	Exam and Quiz	Fall 2015	Philipossian	85%
	402	Assignment 5	Fall 2015	Saez	90%
	413	Students sized a valve to meet an application spec and analyzed two process configurations. ChEE 413 problem set: Size a valve to control the flow of copper nanoparticles suspended in ethylene glycol for a process to screen-print wiring for electrical circuits.	Spring 2016	Muscat	90%
	420	Students solved open ended reactor design and kinetics problems (Any HW or Exam Problem)	Fall 2015	Sorooshian	> 90%
Criterion F – An understanding of professional and ethical responsibility	201	Exam 3 question after highlighting this in class.	Fall 2015	Blowers	100%
	203	Students arrived to class on time handed in assignments in time	Spring 2016	Sorooshian	> 90%
	401A	Students arrived in lab on time all the time and handed in assignment in time all the time.	Fall 2015	Gervasio	100%
	420	Students arrived to class on time handed in assignments in time	Fall 2015	Sorooshian	> 90%
	442	Assignment overlapping safety and ethics.	Fall 2015	Schrader	>90%
	443	In class activities	Spring 2016	Ogden	97%
	477R	Written report on bioethics assignment. Passage (>60% correct) on report.	Fall 2015	Field	94.30%
Criterion G – An ability to communicate effectively (oral and written)	201	Writing Assignment: What I Want to Do When I Graduate?	Fall 2015	Blowers	94%
	201L	Peer evaluations of group presentations.	Fall 2015	Blowers	95%
	401A	Students effectively orally presented "design a lab" presentations and documented details in an associated report; working as a team of 4 in lab and finishing lab reports on time in a professional manner.	Fall 2015	Gervasio	> 90%
	443	Final report, guest lecturers (could have them write a summary if needed for measurement)	Spring 2016	Ogden	100%



Criterion H – The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context	201	Students solve an environmentally relevant problem and use non-textbook citations that demonstrate they are life long learners by being able to find information.	Fall 2015	Blowers	98.10%
	203	Students attended class to hear about numerous examples provided during the semester about the applications of heat transfer and fluid flow to solve real-world issues	Spring 2016	Sorooshian	> 90%
	326	Students had to find data in new sources using the UA library and then correctly cite that data.	Spring 2016	Blowers	100%
	420	Students attended class to hear about numerous examples provided during the semester about the applications of chemical reaction engineering to solve real-world issues	Fall 2015	Sorooshian	> 90%
	443	Final Report	Spring 2016	Ogden	100%
Criterion I – A recognition of the need for, and an ability to engage in life-long learning	201	Students solve an environmentally relevant problem and use non-textbook citations that demonstrate they are life long learners by being able to find information.	Fall 2015	Blowers	98.10%
	326	Students had to find data in new sources using the UA library and then correctly cite that data	Spring 2016	Blowers	100%
	401A	Students used peer reviewed and high quality data sources in their laborator reports.	Fall 2015	Gervasio	100%
	413	Students learn to work with an Arduino to implement a simple control mechanism designed in MATLAB. This requires the students to engage in programming and electrical circuits, teaching the idea that to be successful engineers, students must be able to learn new concepts and be able to use them to solve problems.	Spring 2016	Muscat	77%
Criterion J – A knowledge of contemporary issues	203	Students attended class to hear about numerous examples provided during the semester about the applications of heat transfer and fluid flow to solve real-world issues	Spring 2016	Sorooshian	> 90%
	401A	Students selected comtemporany topic during their "design a lab" presentations	Fall 2015	Gervasio	> 90%
	420	Students attended class to hear about numerous examples provided during the semester about the applications of chemical reaction engineering to solve real-world issues	Fall 2015	Sorooshian	> 90%
	442	Every class students presented a chemical engineering related current event topic during the first five minutes of class.	2013	Sorooshian	100%



Criterion K – An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	201L	Students used VBA integrated with Excel data manipulation to order, organize, and compile GHG emissions from UA flights for work.	Fall 2015	Blowers	100%
	202		Spring 2016	Blowers	100%
	203	Students used Excel on homework assignments	Spring 2016	Sorooshian	> 90%
	301A	Confidence and Prediction Intervals Quiz testing the ability to calculate confidence and prediction intervals for a repeated data point, the confidence interval for the slope and intercept of a best fit line for a set of data, and confidence and prediction intervals for a forecasted value. This was the final quiz in a series of three quizzes on quantifying uncertainties in experimental measurements (topics covered in other quizzes: (1) advanced significant figure calculations involving combined operations and (2) propagation of uncertainties).	Fall 2015	Kiehlbaugh	95%
	401A	Executed experiments for to control pumped flow rate, pressure for membrane separation (reverse osmosis) , determined reaction by acid base and light induced oxidation of chemical decompositions in reactors.	Fall 2015	Gervasio	> 90%
	402	Assignment 8	Fall 2015	Saez	85%
	413	ChEE 413 Exam 1: Create a new vector from an input utilizing basic MATLAB commands and structures.	Spring 2016	Muscat	42%
	420	Students used Excel and Matlab software to solve several chemical reaction engineering problems during the class on homework assignments. HW4 that uses Matlab.	Fall 2015	Sorooshian	>90%
	443	Final report	Spring 2016	Ogden	100%
	Process Safety – An ability to assess and reduce hazards and develop safe operating procedures in the laboratory	201	Online quiz regarding safety	Fall 2015	Blowers
301A		UA online General Laboratory Chemical Safety Course	Fall 2015	Kiehlbaugh	96%
442		Students take online safety class and quiz. Students received electronic certificate to turn in to professor.	Fall 2013	Sorooshian	100%
442		Assignment for the AIChE SACHE modules, and special assignment for report on safety.	Fall 2015	Schrader	>90%
442		Additional assignments that overlap safety and ethics.	Fall 2015	Schrader	>90%
442		Safety Training - students have to turn in certificates.	Fall 2015	Schrader	100%
443		Individual HAZOPs as well as lab safety audit	Spring 2016	Ogden	100%