General Education Course Information Sheet

Please submit this sheet for each proposed course

Department & Course Number CHEM 98T

Course Title Communicating Science: Chemistry in the World Around Us

Indicate if Seminar and/or Writing II course Seminar

1 Check the recommended GE foundation area(s) and subgroups(s) for this course

Foundations of the Arts and Humanities

- Literary and Cultural Analysis _____
- Philosophic and Linguistic Analysis _____
- Visual and Performance Arts Analysis and Practice _____

Foundations of Society and Culture

- Historical Analysis _____
- Social Analysis _____

Foundations of Scientific Inquiry

- Physical Science ✓
  With Laboratory or Demonstration Component must be 5 units (or more) _____
- Life Science _____
  With Laboratory or Demonstration Component must be 5 units (or more) _____

2. Briefly describe the rationale for assignment to foundation area(s) and subgroup(s) chosen.

The proposed course will teach and expose students to various physical science and chemistry topics by analyzing how chemistry is communicated to society every day. Topics include the scientific method, solar cell science, materials and nanoscience, lasers, acids/bases, quantum mechanics and reading journal articles from the scientific literature.

3. "List faculty member(s) who will serve as instructor (give academic rank):
Matthew T. Fontana (Teaching Fellow) advised by Professor Benjamin Schwartz (Professor)

Do you intend to use graduate student instructors (TAs) in this course? Yes _____ No ✓

If yes, please indicate the number of TAs N/A

4. Indicate when do you anticipate teaching this course over the next three years:

2013-2014	Fall		Winter		Spring	
	Enrollment		Enrollment		Enrollment	
2014-2015	Fall		Winter		Spring	
	Enrollment		Enrollment		Enrollment	
2015-2016	Fall		Winter		Spring	✓
	Enrollment		Enrollment		Enrollment	18

5. GE Course Units

Is this an ***existing*** course that has been modified for inclusion in the new GE? Yes ___ No ✓

If yes, provide a brief explanation of what has changed. NA

Present Number of Units: NA Proposed Number of Units: 5

6. Please present concise arguments for the GE principles applicable to this course.

❑ General Knowledge	Multiple science communication forms will be analyzed and the respective science content will be investigated thereby providing a broad range of topics to discuss across physical science and chemistry.
❑ Integrative Learning	Students will be exposed to multiple popular science communicators and asked to evaluate what in particular makes them so effective/popular. Content will be learned by reading from multiple sources from different disciplines.
❑ Ethical Implications	A major component of this class will focus on the importance of clear science communication for society with regards to promoting science literacy. Topics such as science misconceptions, stereotypes, and science policy will be discussed.
❑ Cultural Diversity	Students will learn that science is a social activity which requires frequent communication and collaboration, often with people from various backgrounds across the world. For example, visiting scholars at national labs.
❑ Critical Thinking	Students will develop the critical thinking to distill and clearly communicate an idea. Students will learn to how to read and draw a conclusion from a scientific paper and how to interpret diagrams and graphs.
❑ Rhetorical Effectiveness	Various forms of science communication will be learned and practiced though writing assignments. Different supplemental readings will be assigned where students will practice speech as they communicate/teach the material to the class.
❑ Problem-solving	Students will be presented with scientific phenomena and guided through the process by which scientists systematically design and perform experiments to explain the phenomena and build a physical picture.
❑ Library & Information Literacy	Students will be assigned journal articles to read and will access them through the UCLA Web of Science database. Their final research paper will have the students draw upon multiple library resources to gather and organize information.

(A) STUDENT CONTACT PER WEEK (if not applicable write N/A)

1.	Lecture:	**2.8**	(hours)
2.	Discussion Section:	**N/A**	(hours)
3.	Labs:	**N/A**	(hours)
4.	Experiential (service learning, internships, other):	**N/A**	(hours)
5.	Field Trips:	**N/A**	(hours)
		0.2	
(A) TOTAL Student Contact Per Week		**3**	**(HOURS)**

(B) OUT-OF-CLASS HOURS PER WEEK (if not applicable write N/A)

1.	General Review & Preparation:	**1**	(hours)
2.	Reading	**6**	(hours)
3.	Group Projects:	**0**	(hours)
4.	Preparation for Quizzes & Exams:	**0**	(hours)
5.	Information Literacy Exercises:	**1**	(hours)
6.	Written Assignments:	**2**	(hours)
7.	Research Activity:	**2**	(hours)
(B) TOTAL Out-of-class time per week		**12**	**(HOURS)**
GRAND TOTAL (A) + (B) must equal at least 15 hours/week		**15**	**(HOURS)**

Communicating Science: Chemistry in the World Around Us

Instructor:

Matthew Fontana
Office: Young Hall 2085G
Email: fontanam@ucla.edu
Office Hours: To be determined

Seminar Description:

Effective science communication fosters an understanding of our physical world. Science communication in the education system, literature, media, television, science fiction and popular culture will be investigated (and practiced!) to learn the best ways to communicate and learn chemistry.

Meetings:

- Time: To be determined
- The first meeting of the week will focus on the science content of the assigned readings for the week. Since teaching science is the best way for you to learn science and effective communication is the main theme of this class, the science content will be solidified through discussions led by myself and will rely heavily on the input of you and your peers to teach and question each other, modeling the scientific method. In this way, the science content will be learned through various active-learning activities. The second meeting of the week will be a group discussion focusing on applying the concepts from the readings to evaluate the pros, cons and implications of each form of communication. The communication forms will be analyzed with regard to their ability to highlight and illustrate the research process of developing new science.

Class structure:

- The class will be assigned a core selection of readings which everyone is expected to complete each week. In addition to the core readings, supplemental group discussion readings will be assigned. The class will be divided into small groups and each group will be assigned different supplemental reading material. To facilitate active discussions, members from each group will teach the class what they learned from the supplemental readings facilitating a discussion on the material.
- Throughout the quarter, the class will visit various UCLA research facilities for 20 to 30 minute tours. These facilities include a solar cell research lab, the Molecular Instrumentation Center (MIC) and the California NanoSystems Institute (CNSI). These tours will provide a way to see science in action along with the instrumentation and facilities required to do science. These facilities provide the means to learn about many of the materials and concepts discussed in this seminar.

Readings:

- Russell, N. *Communicating Science: Professional, Popular, Literary*; Cambridge University Press: New York, 2010.
- Miodownik, M. *Stuff Matters: Exploring the Marvelous Materials That Shape Our Man-Made World*; Houghton Mifflin Harcourt Publishing Company: New York, 2014.
- Kaku, M. *Physics of the Impossible*; Doubleday: New York, 2008.
- Cavelos, J. *The Science of Star Wars*; St. Martin's Griffin: New York, 2000.
- Selected Journal Articles

Learning Objectives:

In this course you will:

- Gain an appreciation for living in a world of chemistry. Be able to identify chemistry concepts and apply scientific theories to everyday occurrences and current events. Gain a deeper understanding and appreciation for the world we live in.
- Analyze the relative merits of various communication forms and see how each is particularly effective in improving science awareness and literacy.
- Learn how scientists approach real world problems to do science and in particular how popular/successful science communicators convey this process to the public.
- Access how common nanotechnology devices such as solar cells are based on concepts beyond the average science background and the need for increased science outreach and laboratory demonstrations.
- Study organic solar cells as an example of a highly interdisciplinary research field relying on collaboration of scientists in multiple fields. Learn how these scientists follow the scientific method by collecting data, analyzing results and communicating iteratively to plan and design future experiments.
- Gain experience with how to perform literature research and how to read a scientific paper. Learn that each paper communicates new units of knowledge and is a contribution to a growing body of collective scientific knowledge. Gain exposure to controversies in the literature and how to subsequently draw careful conclusions.

Prerequisites:

- None! A healthy class discussion will result from people with multiple perspectives and educational backgrounds.

Course Requirements:

Weekly Readings:

- The weekly readings must be completed by the first meeting of the week in which the topic will be discussed.

Weekly Reading Evaluations (20% of total grade):

- A one-page reading evaluation will be due on the first meeting of each week.
- The evaluation will discuss what you learned, found particularly interesting and were confused about. For what you learned, you will need to include scientific background on the theory. For what you are confused about I will do my best to clear it up during the week's discussions.

Class Discussions (20% of total grade):

- Critical to your success in this course and what you take away from it will be active participation in the class discussions. The quality and quantity of what you say are equally valued. Not only must you participate frequently, but what you say needs to be informed. Key to being successful in this is doing the assigned readings. Questions are welcome! Many times a good question is just as insightful as a good answer since active questioning is what drives the scientific process.
- To foster a good discussion for the second class meeting you will need to review the readings with the new insight gained from the first meeting.

Simple Chemistry Explanation (5% of total grade):

- Explain the main essence of a chemistry or nanoscience phenomenon in half a page to one-page using the 1000 most commonly used words in the English language.
- Due Week 2

"Hello, I'm Carbon" (5% of total grade):

- Identify an element and write a one to two-page autobiography of that element.
- Due Week 3

Chemistry Picture (5% of total grade):

- Draw a picture of a real-life event or situation to describe a chemistry or nanoscience concept. No words can be in the picture! Other pictures must instead be used to describe science concepts.
- Due Week 4

What Makes A Popular Science Communicator So Effective? (10% of total grade):

- Write a 3-4 page essay analyzing different popular science communicators and ultimately what makes them so effective? How do they approach science differently than others and what makes them so effective in clearly communicating science to the general public?
- Due Week 6

Chemistry in TV (5% of total grade):

- Watch an episode of a TV show which deals with a chemistry or nanoscience concept and write a two-page reflection on the science presented in the show. For example, an appropriate show would be a crime show which has elements of forensic science. Additionally, explain the theory demonstrated in the show and whether it is an accurate representation of chemistry or not. Lastly, discuss how the inclusion of this chemistry concept advances scientific understanding or perhaps misrepresents science.
- Due Week 7

Chemistry Meme (5% of total grade):

- Find a chemistry or nanoscience meme (or make your own!) and explain in one-page the science required to understand the meme.
- Due Week 9

Critical Analysis of a Chemistry Concept (25% of total grade):

- Identify a chemistry or nanoscience concept and investigate the multiple ways in which it is communicated in society. Are some avenues of communication more effective for it than others? Why is it important that this concept be communicated? The concept must be thoroughly explained (if you need help understanding the topic please ask me) and furthermore, explained clearly so that a non-science person can understand what you are talking about. I suggest reading it to a friend or roommate to practice.
- Approximately five pages
- Choose chemistry or nanoscience concept by Week 5
- Rough First Draft due on the first meeting of Week 8, Rough First Draft returned to you on the second meeting of Week 8.
- Final Draft due in the first class meeting of Week 10

Totals:

- Readings: 70 pages per week, on average
- Writing: 23 to 25 pages
- Exams: None

Detailed Lecture and Reading Schedule:

- **Week 1:** ***Communicating the Language of Science***
  - Science Content: The Scientific Method, Models of the Atom, Hydrogen Atom, Light Emitting Diodes
  - Core Readings:
    - Communicating Science: 69-82.
    - Laaperi, A., "OLED Lifetime Issues From A Mobile-Phone-Industry Point of View", *Journal of the Society for Information Display*, **16**(11), 1125-1130 (2008).
  - Group Discussion Readings:
    - Durrant, J. R. "Copernicus and Conan Doyle or Why Should We Care About the Public Understanding of Science?" *Science and Public Affairs*, **5**, 7-22 (1990).
    - Durrant, J. R., Evans, G. A., and Thomas, G. P., "The Public Understanding of Science" *Nature*, **340,** 11-13 (1989).
    - Scotchmoor, J., Thanukos, A. and Potter, S., "Improving The Public Understanding of Science: New Initiatives" *American Journal of Botany*, **96**(10), 1760-1766 (2009).
- **Week 2:** ***The Role of Science Communicators in Science Literacy***
  - Science Content: Light, Index of Refraction, Solar Cell Fundamentals
  - Core Readings:
    - Communicating Science: 83-115
    - Physics of the Impossible: 16-33
    - The Great Debate - The Storytelling of Science (2 hours and 15 minutes)
  - Group Discussion Readings:
    - Macoubrie, J., "Nanotechnology: Public Concerns, Reasoning and Trust in Government" *Public Understanding of Science*, **15**, 221-241 (2006).
    - Chadwick, N., Robertson, N., "Can Solar Power Change the World?" *The Mole*, **1**, 1-3 (2012).
    - Gómez, R. and Segura, J. L., "Plastic Solar Cells: A Multidisciplinary Field To Construct Chemical Concepts from Current Research" *Journal of Chemical Education*, **84**(2), 253-258 (2007).
  - Science Activity:
    - Laboratory tour of solar cell research laboratory given by Matthew Fontana
- **Week 3:** ***Science in the Education System***
  - Science Content: Dye Sensitized Solar Cells (DSSCs) as Science Outreach, Photoelectric Effect, Nanotechnology, Redox Chemistry, Student Data on DSSC Solar Cell Experiment
  - Core Readings:
    - Communicating Science: 116-131
    - Hartings, M. R. and Fahy, D., "Communicating Chemistry for Public Engagement" *Nature Chemistry*, **3**, 674-677 (2011).

    - Stout, R. P., "'Hello, I'm Carbon.': Writing About Elements and Compounds" *Journal of Chemical Education*, **87**(11), 1163-1165 (2010).
    - Danipog, D. L. and Ferido, M. B., "Using Art-Based Chemistry Activities To Improve Students' Conceptual Understanding in Chemistry" *Journal of Chemical Education*, **88**, 1610-1615 (2011).
  - Group Discussion Readings:
    - Driel, J. H. v., Verloop, N. and de Vos, W., "Developing Science Teachers' Pedagogical Content Knowledge" *Journal of Research in Science Teaching*, **35**(6), 673-695 (1998).
    - Ding, N. and Harskamp, E. G., "Collaboration and Peer Tutoring in Chemistry Laboratory Education" *International Journal of Science Education*, **33**(6) 839-863 (2010).

- **Week 4:** ***Materials and the World Around Us: Part I***
  - Science Content: Crystals, Crystal Structure, Colors of Materials, Aerogels
  - Core Readings:
    - Stuff Matters: Exploring the Marvelous Materials That Shape Our Man-Made World: 1-49.
  - Group Discussion Readings:
    - Stuff Matters: Exploring the Marvelous Materials That Shape Our Man-Made World: 51-71.
    - Stuff Matters: Exploring the Marvelous Materials That Shape Our Man-Made World: 73-90.
    - Stuff Matters: Exploring the Marvelous Materials That Shape Our Man-Made World: 91-110.

- **Week 5:** ***Materials and the World Around Us: Part II***
  - Science Content: Polymers, Crystalline and Amorphous Silica, Carbon Allotropes, Approaches to Materials Creation
  - Core Readings:
    - Stuff Matters: Exploring the Marvelous Materials That Shape Our Man-Made World: 111-157, 215-226.
  - Group Discussion Readings:
    - Stuff Matters: Exploring the Marvelous Materials That Shape Our Man-Made World: 159-178.
    - Stuff Matters: Exploring the Marvelous Materials That Shape Our Man-Made World: 179-193.
    - Stuff Matters: Exploring the Marvelous Materials That Shape Our Man-Made World: 195-213.
  - Science Activity:
    - Laboratory tour of the Molecular Instrumentation Center (MIC) by Dr. Jane Strouse (Director of MIC)

- **Week 6:** ***Science in Literature and the Media***
  - Science Content: Public Perception of Solar Energy and Economic Limitations: Limitations of Large Area Solar Cells, Sequential Processing as an Avenue to Large Area Devices
  - Core Readings:
    - Communicating Science: 135-201 and 247-315.
    - Crichton, M., "Ritual Abuse, Hot Air, and Missed Opportunities" *Science*, **283**, 1461-1463.
  - Group Discussion Readings:

* Krebs, F. C., Espinosa, N., Hösel, M. Søndergaard, R. R., and Jørgensen, M., "25th Anniversary Article: Rise to Power - OPV-Based Solar Parks" *Advanced Materials*, **26**, 29-39 (2014).
* Emmott, C. J. M., Urbina, A. and Nelson, J., "Environmental and Economic Assessment of ITO-Free Electrodes for Organic Solar Cells" *Solar Energy Materials and Solar Cells*, **97**, 14-21 (2012).
* Haynes, R., "From Alchemy to Artificial Intelligence: Stereotypes of the Scientist in Western Literature" *Public Understanding of Science*, **12**(3), 243-253 (2003).

- **Week 7: *Science in TV***
  - Science Content: Acids and Bases, Chemical Safety and Safety Consciousness, Chemical Hazard Communication, Organic Chemistry, Chemical Synthesis, Semiconducting Polymers, Organic Molecules Used for Organic Solar Cells
  - Core Readings:
    * Dudo, A., Brossard, D., Shanahan, J., Scheufele, D. A., Morgan, M. and Signorielli, N., "Science on Television in the 21^{st} Century: Recent Trends in Portrayals and Their Contributions to Public Attitudes Toward Science" *Communication Research*, **38**(6), 754-777 (2011).
    * Heyman, K., "Talk Nerdy to Me" *Science*, **320**, 740-741 (2008).
    * Suchland, S., "Professor Serves As Science Consultant For Show." Daily Bruin [Los Angeles] 5 Jan. 2010: Online.
    * Hare, J., "Breaking Bad II - Acid Bath Disposal of Bodies" *InfoChem*, **129**, 5 (2011).
    * *UCLA* Office of Environment, Health and Safety, "Chapter 2: Chemical Hazard Communication" *Chemical Hygiene Plan*, 1-6 (2014).
    * *Hydrofluoric Acid*; MSDS No. 339261 [Online] Sigma-Aldrich: Saint Louis, MO, December 9, 2014, http://www.sigmaaldrich.com/catalog/product/sial/339261?lang=en&region=US.
    * Matsuno, K., "The Treatment of Hydrofluoric Acid Burns" *Occupational Medicine*, **4**(4), 313-317 (1996).
  - Group Discussion Readings:
    * "The 2000 Nobel Prize in Chemistry - Popular Information". Nobelprize.org. Nobel Media AB 2014. Web. 28 Feb 2015. <http://www.nobelprize.org/nobel_prizes/chemistry/laureates/2000/popular.html
    * Hare, J., "Breaking Bad III - Thermite Break-In" *The Mole*, **1**, 10 (2012).
    * Wilson, K., "Television Weathercasters As Science Communicators" *Public Understanding of Science*, **17**(1), 73-87 (2008).
  - Guest Speaker:
    * Guest talk given by Professor David Saltzberg (UCLA Professor of Physics and Astronomy and science consultant to "The Big Bang Theory") - Pending.

- **Week 8: *Science Fiction: Part I***
  - Science Content: Quantum Mechanics, Lasers
  - Core Readings:
    * The Science of Star Wars: 1-38
    * Byko, M., "The (Mostly Improbable) Materials Science and Engineering of the Star Wars Universe" *Journal of the Minerals, Metals and Materials Society*, **57**(5), 12-18 (2005).
    * Physics of the Impossible: 34-54
  - Group Discussion Readings:
    * The Science of Star Wars: 39-77
    * The Science of Star Wars: 78-125

  - Science Activity:
    * Laboratory tour of the California NanoSystems Institute (CNSI) given by Dr. Jia Chen (Education Director of CNSI)

- **Week 9:** ***Science Fiction: Part II***
  - Science Content: Thermodynamics, Thermodynamic Engines, Refrigeration
  - Core Readings:
    * The Science of Star Wars: 126-175
    * Physics of the Impossible: 154-178
  - Group Discussion Readings:
    * Physics of the Impossible: 197-215
    * The Science of Star Wars: 176-207
    * The Science of Star Wars: 207-241

- **Week 10:** ***Science in Popular Culture and the Internet***
  - Science Content: Periodic Table, Nanotechnology, Liquid Nitrogen, Kinematics
  - Core Readings:
    * Communicating Science: 28-39
    * Physics of the Impossible: 55-69
    * Poliakoff , M. and Tang, S., "The Periodic Table: Icon and Inspiration" *Philosophical Transactions A*, **373**: 20140211, 1-9 (2015).
    * Coppola, B. P., Hovick, J. W. and Daniels, D. S., "I Scream, You Scream...: A New Twist on the Liquid Nitrogen Demonstrations" *Journal of Chemical Education*, **71**(12), 1080 (1994).
    * Rodrigues, M. and Carvalho, P. S., "Teaching Physics with Angry Birds: Exploring the Kinematics and Dynamics of the Game" *Physics Education,* **48**(4), 431-437 (2013).
  - Group Discussion Readings:
    * Smith, D. K., "iTube, Youtube, WeTube: Social Media Videos in Chemistry Education and Outreach" *Journal of Chemical Education*, **91**, 1594-1599 (2014).
    * Runge, K. K., Yeo, S. K., Cacciatore, M., Scheufele, D. A., Brossard, D., Xenos, M., Anderson, A., Choi, D.-H., Kim, J., Li, N., Liang, Z., Stubbings M. and Su, L. Y.-F., "Tweeting Nano: How Public Discourses About Nanotechnology Develop in Social Media Environments" *Journal of Nanoparticle Research*, **15**(1):1381, 1-11 (2013).
    * Jacobsen, E. K. and Groat, R. K., "Support Your Favorite Element on Facebook: A Post-National Chemistry Week Update" *Journal of Chemical Education*, **87**(3), 237-238 (2010).
  - Science Activity:
    * Making liquid nitrogen ice cream

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New Course Proposal

Chemistry & Biochemistry 98T
Communicating Science: Chemistry in the World Around Us

Course Number Chemistry & Biochemistry 98T

Title Communicating Science: Chemistry in the World Around Us

Short Title

Units Fixed: **5**

Grading Basis Letter grade only

Instructional Format Seminar - 3 hours per week

TIE Code SEMT - Seminar (Topical) [T]

GE Requirement Yes

Major or Minor Requirement No

Requisites Enforced requisite: satisfaction of Entry-Level Writing requirement. Freshmen/sophomores preferred.

Course Description Effective science communication fosters an understanding of our physical world. Science communication in the education system, literature, media, television, science fiction and popular culture will be investigated (and practiced!) to learn the best ways to communicate and learn chemistry.

Justification Part of the series of seminars offered through the Collegium of University Teaching Fellows

Syllabus File *Fontana_Syllabus.pdf* was previously uploaded. You may view the file by clicking on the file name.

Supplemental Information Professor Benjamin Schwartz is the faculty mentor for this course

Grading Structure 20% weekly reading evaluations; 20% class discussions; 35% weekly assignments; 25% critical analysis paper

Effective Date Spring 2016

Discontinue Date Summer 1 2016

Instructor

Name	Title
Matthew Fontana	Teaching Fellow

Quarters Taught ☐ Fall ☐ Winter ☑ Spring ☐ Summer

Department Chemistry

Contact

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Routing Help

ROUTING STATUS

Role: FEC Chair or Designee - Castillo, Myrna Dee Figuracion (MCASTILLO@COLLEGE.UCLA.EDU) - 45040
Status: Pending Action

Role: CUTF Coordinator - Chen, Michelle L. (MCHEN@OID.UCLA.EDU) - 53042
Status: Approved on 6/26/2015 2:32:09 PM
Changes: No Changes Made
Comments: on behalf of Professor Kathleen L. Komar, chair of the CUTF Faculty Advisory Committee

Role: Initiator/Submitter - Chen, Michelle L. (MCHEN@OID.UCLA.EDU) - 53042

Status: Submitted on 6/26/2015 10:18:04 AM

Comments: Initiated a New Course Proposal

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