General Education Course Information Sheet

Please submit this sheet for each proposed course

Department & Course Number	Chemistry 98T
Course Title	What is nanoscience?
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 X
  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.

This course will explore science at the nanometer scale in both physical and biological systems. Students will perform experiments, which will illustrate how the specific properties of nanometer scale objects can be used to solve complex real-world problems.

3. List faculty member(s) who will serve as instructor (give academic rank):
Christian Beren, Teaching Fellow; William Gelbart, Professor

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

If yes, please indicate the number of TAs ____

4. Indicate when do you anticipate teaching this course:

2016-2017	Fall		Winter	X	Spring	
	Enrollment	____	Enrollment	____	Enrollment	____

5. GE Course Units

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

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

Present Number of Units: ____ Proposed Number of Units: 5

6.

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

❑ General Knowledge	Students will learn about basic scientific problems which are being addressed using nanoscience. They will learn fundamental physical principles related to the experimental topics discussed in class.
❑ Integrative Learning	This course uses hands-on experimentation to allow students to explore new scientific ideas. They will be asked to make connections to science that they have seen before to develop their understanding of new phenomena. They will also be asked to develop their own question related to the work we do throughout the quarter, and to collect data to answer that question.
❑ Ethical Implications	Scientific developments towards green energy will be discussed, as will the use of science in medicine. Students will also be exposed to the proper ways to cite previous work and search existing literature.
❑ Cultural Diversity	Cultural diversity will not be expressly discussed in the course. Though the importanc of collaboration, open dialogue, and openmindedness to scientific progress will be discussed.
❑ Critical Thinking	Students will be collecting scientific data, and will be asked to analyze the data to develop their own understanding of the science they are exploring.
❑ Rhetorical Effectiveness	Students will be asked to discuss their data, and its implications for their own understanding in class. They will also be asked to present on an experiment of their own design at the end of the term.
❑ Problem-solving	Students will be asked to analyze the data they collect in the labs. They will also be asked to develop an experimental method for answering a question of their own related to the topics discussed in the course.
❑ Library & Information Literacy	Students will be shown how to read scientific literature, and will be asked to explore the literature to further their understanding of the topics discussed in class.

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

1. Lecture:	**3**	(hours)
2. Discussion Section:		(hours)
3. Labs:		(hours)
4. Experiential (service learning, internships, other):		(hours)
5. Field Trips:		(hours)

(A) TOTAL Student Contact Per Week 3 **(HOURS)**

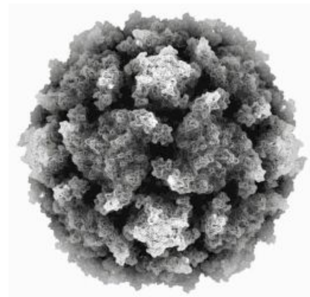
(B) OUT-OF-CLASS HOURS PER WEEK (if not applicable write N/A)

1. General Review & Preparation:	3	(hours)
2. Reading	3	(hours)
3. Group Projects:		(hours)
4. Preparation for Quizzes & Exams:		(hours)
5. Information Literacy Exercises:		(hours)
6. Written Assignments:	3	(hours)

7. Research Activity: 3 (hours)

(B) TOTAL Out-of-class time per week	12	**(HOURS)**
GRAND TOTAL (A) + (B) must equal at least 15 hours/week	15	**(HOURS)**

What is nanoscience?



28 nm diameter virus particle

Christian Beren
ceb311@gmail.com
Young Hall 3107C

Introduction:

In this class you will perform experiments designed by the California NanoSystems Institute (CNSI) High School Nanoscience Program to teach the advantages of research science at the nanometer scale. Each experiment utilizes procedures adapted from modern research, allowing you to actively engage with a variety of complex scientific and engineering problems that are being worked on today (i.e. improving solar cells using nanotechnology). Students will experience how science is used to improve our understanding of the world around us, and how scientific progress can lead to technological innovation.

Objectives:

1. Understand how nanoscience is used to solve real-world scientific and engineering problems
2. Use the scientific method to drive experimentation and critical analysis of scientific data
3. Understand how basic research drives technological innovation
4. Develop skills in presenting scientific data both orally and textually
5. Introduce the tools and practices used to perform cutting-edge research
6. Promote the importance of an open-dialogue towards scientific progress

Required Texts: Each experiment has its own student manual and a corresponding powerpoint outlining the science behind the experiment. You are expected to have read both the student manual and the powerpoint *before* the first class meeting of the week to be prepared for the experiment. In addition, each experiment has some suggested readings from scientific literature which you can read to clarify your thinking throughout the experimental module.
All required readings will be provided on the course website and the complete reading list for the course can be found at the end of this syllabus.

Class participation:

Throughout this course you will perform experiments and discuss your results. The remaining class-time will be driven by discussion of suggested readings and presentation of your own experimental plans (detailed below in the Short Response Essays section).

Weekly Posts to the Class Forum:

You are encouraged to post your thoughts on topics discussed in the course to the discussion board (found on the course website), and to post any outside information you find to be interesting and pertinent to the course.

Laboratory Notebook:

Each week we will perform an experiment, and you are expected to keep a laboratory notebook detailing your methodology, data and experimental observations. In addition, at the beginning of each experiment I will perform a science demonstration related to the experiment. You will record an explanation of the science behind the demonstration in your lab notebook. You will update your explanation as you learn more about the topic through experimentation and class discussion.

Short Response Essays:

At the end of each experiment you will write a short (less than 1 page) response to the experiment outlining questions you still have about the topic, as well as potential experiments that could be performed to answer these questions. You are encouraged to include information gathered from scientific literature in these responses.

Final Paper:

The final paper will take the form of a research paper. You will expand upon one of the experiments performed in class, developing your own experimental plan and performing this experiment during class time. You are expected to develop a motivation for the experiment, explain the experimental methodology and results, and discuss the implications of the results for future works. The final paper will be due at the end of the quarter, but a firm rough draft of the paper will be turned into me no later than the end of week 8. We will meet during the writing process to discuss your research paper so that I can provide guidance on the experimental design.

End of Term Presentation:

As each of you will be performing an experiment of your own design, each student will also present their research to the class during the last meeting of the quarter. You are encouraged to promote an active discussion during these presentations, so that every student in the class can learn as much as possible about the exciting work presented.

Grading:

Class Participation: 10%
Weekly Posts to the Course Forum: 5%
Laboratory Notebook: 25%
Short Response Essays 25%
Research Paper Final Draft: 25%
Research Final Presentation: 10%

Unique Educational Needs:

Students with disabilities or any student in need of special accommodations; please notify me and the Office of Student Disabilities (OSD; http://www.osd.ucla.edu).

Schedule:

Each week students will perform a specific experiment. You are expected to read the corresponding literature for each experiment before the first class meeting of the week. We will perform the experiment during the first meeting of the week, with some lecture/discussion of the concepts to develop your understanding of the science behind the experiment. After completing the experiment, you will write a short response to the experiment, which will be used as part of the discussion during the second meeting of the week.

Week 1: Superhydrophobic Surfaces

Superhydrophobic and superhydrophilic surfaces repel or attract water, respectively. These surfaces are being developed for a variety of applications ranging from keeping cell phone screens dry to biomedical implant devices. The experiment will focus on teaching students the molecular interactions that create hydrophobicity and hydrophilicity, as well as the nanoscale surface properties that create superhydrophobicity and superhydrophilicity.

Week 2: Water Purification

Access to purified water is a luxury we take for granted in developed nations, but much of the world still operates on a daily basis without a treated water supply. Infrastructure in these regions is slow to develop, so engineering cheap, effective, and simple-to-use water filtration systems is the desired method for bringing clean water to these areas. In this lab, students will learn first-hand the types of impurities commonly present in untreated water, and they will learn and work with several recent technologies that utilize nanoscience to treat water cheaply and effectively.

Week 3: Biotoxicity

This experiment illustrates how nanoscience is particularly relevant in biology, as most biological machinery (several examples include viruses, ribosomes, polymerases) is between 1 and 100 nanometers in size (which is the size range defined by nanoscience!). In this lab, students will study the effect of several different silver substances (silver ions, silver nanoparticles and bulk silver metal) on the respiration of yeast. Students will understand why the nanoparticles effectively reduce yeast respiration while the other forms of silver are ineffective. As my PhD work focuses on viruses, which are themselves biological nanoparticles (viruses are typically between 30-100 nm in size), we will discuss why evolution has directed viruses to maintain this size.

Week 4: Solar Cells

The sun provides more than enough solar energy to fuel the world's energy needs. However, the technology is not yet there to harness that energy and turn it into usable work. This lab focuses on current fabrication techniques for solar cell technology, in particular how nanomaterials are being used to improve solar cells. In addition, students will learn how solar cells and photosynthesis rely on the same physical principles.

Week 5: Biopolymers
Living organisms are comprised almost entirely of nanometer-sized molecules called biological polymers (or biopolymers). Biopolymers comprise everything from genetic materials (DNA and RNA) to the enzymes that drive biochemical processes in your body (proteins) to the outer layer of each and every cell (lipids) to the energy sources for all living systems (sugars/carbohydrates). Students will learn what polymers are, their unique properties, and why they are used so ubiquitously in biology. In particular, the properties of biological membranes (lipids) will be directly investigated in this experiment.

Week 6: Supercapacitors
While renewable energy sources are providing novel methods for generating energy, developing better methods to store energy is of equal importance. Portable devices utilize batteries, capacitors and supercapacitors as storage devices, with each offering advantages and disadvantages over the other types of storage. Batteries provide the largest amount of energy storage, but they cannot provide much power (power is how much energy you can deliver over a certain amount of time). On the other hand, capacitors can provide lots of power but cannot store much energy. Supercapacitors, a relatively newer technology, aim to provide high energy storage values with high power outputs. In this lab, students will fabricate their own supercapacitor and learn how nanoscience is being used to drive better performance in these devices.

Week 7: Photolithography
Photolithography is a top-down approach to engineering, and it is used everyday to produce smaller and more powerful electronics. Photolithography uses light to pattern surfaces. Students will use this process to create small metallic wires on a surface, allowing them to measure the resistance across each wire as a function of wire thickness. Students who have previously seen a computer motherboard (or similar electronics) will immediately realize their similarity to the device fabricated in this lab.

Week 8: Perform your own experiments
Students will perform an experiment of their own design based on a previous experiment from the course.

Week 9: Self-Assembly
Self-assembly is the spontaneous ordering of objects from a disordered state. It is fundamental to both molecular biology and the formation of solid crystals, and many researchers are working to develop self-assembling systems (for example, DNA origami) for use in a variety of applications. In this lab, students will self-assemble magnetic beads (atoms) floating in a pool of water. Students will see how simple interactions can lead to diverse and complicated ordered structures. As my PhD work is heavily focused on the self-assembly of viruses, several papers on viral self-assembly will also be discussed, and several demonstrations related to viral self-assembly will be performed as well.

Week 10: Final Presentations
Students will give their final presentations on the results they obtained for their own experiments. Students are encouraged to ask questions and engage in an open-dialogue during these presentations.

New Course Proposal

	Chemistry & Biochemistry 98T **What is Nanoscience?**
Course Number	**Chemistry & Biochemistry 98T**
Title	**What is Nanoscience?**
Short Title	**WHAT IS NANOSCIENCE**
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: Satisfaction of entry-level Writing requirement. Freshman and sophomores preferred.**
Course Description	**Explore how science is used to solve real-world problems. In particular, students will perform hands-on experiments adapted from current research procedures and investigate complex scientific questions related to those experiments.**
Justification	**Part of the series of seminars offered through the Collegium of University Teaching Fellows**
Syllabus	File *Chem 98T Syllabus.pdf* was previously uploaded. You may view the file by clicking on the file name.
Supplemental Information	**Professor William Gelbart is the faculty mentor for this course.**
Grading Structure	**Class Participation: 10%** **Weekly Posts to the Course Forum: 5%** **Laboratory Notebook: 25%** **Short Response Essays 25%** **Research Paper Final Draft: 25%** **Research Final Presentation: 10%**
Effective Date	**Winter 2017**
Discontinue Date	**Summer 1 2017**
Instructor	Name: **Christian Beren** — Title: **Teaching Fellow**
Quarters Taught	☐ Fall ☑ Winter ☐ Spring ☐ Summer
Department	**Chemistry**
Contact	Name: **MICHELLE CHEN** — E-mail: **mchen@oid.ucla.edu**
Routing Help	

ROUTING STATUS

Role:	Registrar's Publications Office
Status:	Pending Action

Role:	Registrar's Scheduling Office - Thomson, Douglas N (DTHOMSON@REGISTRAR.UCLA.EDU) - 51441
Status:	Added to SRS on 8/12/2016 11:52:51 AM
Changes:	Short Title

Comments:	No Comments

Role:	FEC School Coordinator - Kikuchi, Myrna Dee Castillo (MKIKUCHI@COLLEGE.UCLA.EDU) - 45040
Status:	Approved on 8/11/2016 3:44:23 PM
Changes:	No Changes Made
Comments:	Routing to Doug Thomson in the Registrar's Office.

Role:	FEC Chair or Designee - Bristow, Joseph E (JBRISTOW@HUMNET.UCLA.EDU) - 54173
Status:	Approved on 7/28/2016 8:50:12 AM
Changes:	No Changes Made
Comments:	great syllabus!

Role:	FEC Chair or Designee - Kikuchi, Myrna Dee Castillo (MKIKUCHI@COLLEGE.UCLA.EDU) - 45040
Status:	Returned for Additional Info on 7/27/2016 4:03:13 PM
Changes:	No Changes Made
Comments:	Routing to Joe Bristow for FEC approval.

Role:	CUTF Coordinator - Chen, Michelle L. (MCHEN@OID.UCLA.EDU) - 53042
Status:	Approved on 7/13/2016 4:01:22 PM
Changes:	No Changes Made
Comments:	on behalf of Professor Kathleen L. Komar, Chair, CUTF Faculty Advisory Committee

Role:	Initiator/Submitter - Chen, Michelle L. (MCHEN@OID.UCLA.EDU) - 53042
Status:	Submitted on 7/13/2016 3:45:52 PM
Comments:	Initiated a New Course Proposal

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Comments or questions? Contact the Registrar's Office at
cims@registrar.ucla.edu or (310) 206-7045