4-5-11

LONG SIGNATURE SHEET

UNC CHARLOTTE

Proposal Number: NANO 04-29-2010

Proposal Title Establishment of Nanoscale Science Core Courses and a Special Topics Course

Originating Department Chemistry

TYPE OF PROPOSAL: UNDERGRADUATE______ GRADUATE X UNDERGRADUATE & GRADUATE____
(Separate proposals sent to UCCC and Grad. Council)

DATE RECEIVED	DATE CONSIDERED	DATE FORWARDED	ACTION	SIGNATURES
2/4/11	2/4/11	2/4/11	Approved	DEPARTMENT CHAIR [signature] [print name here] Bernadette T. Donovan-Merkert
	2/11/2011		Approved	COLLEGE CURRICULUM COMMITTEE CHAIR [signature] Print name: Cheryl L. Brown
	2/18/2011	2/18/2011	Approved	COLLEGE FACULTY CHAIR [signature] Print name: JOE KUHNS
		2/18/11	Approved	COLLEGE DEAN [signature] Print name here if signing on behalf of Dean: CHARLES BRODY
			Approved	UNDERGRADUATE COURSE & CURRICULUM COMMITTEE CHAIR (for undergraduate courses)
2/23/11	4/5/11	6/17/11	Approved	GRADUATE COUNCIL CHAIR (for graduate courses) Rob Roy McGregor
			Approved	FACULTY GOVERNANCE SECRETARY (noting Faculty Council approval on Consent Calendar)
				FACULTY EXECUTIVE COMMITTEE (if decision is appealed)

Revised 10/20/10
OAA/cag

University of North Carolina at Charlotte **NANO 04-29-2010**

New Graduate Courses

Proposal from: Department of Chemistry and the Nanoscale Science Ph.D. Program

Title: Establishment of Nanoscale Science Core Courses and a Special Topics Course

A. Proposal Summary and Catalog Copy

1. **Summary.** The Nanoscale Science Ph.D. Program proposes to officially establish the program's core courses (NANO 8001, NANO 8101, NANO 8102, NANO 8103, NANO 8104, NANO 8201, NANO 8202, NANO 8203, NANO 8681, NANO 8682, NANO 8900) and a special topics course (NANO 8060).

2. **Proposed Catalog Copy.**

NANO 8001. Perspectives at the Nanoscale. (2) NANO program faculty members present and discuss their research in nanoscale science to: (1) demonstrate how scientists from different disciplines approach problem-solving at the nanoscale, and (2) expose students to research opportunities for dissertation work. Students write summaries of the presentations. *(Fall)*

NANO 8060. Special Topics in Nanoscale Science. (1-3) Prerequisite: permission of the instructor. Selected topics in nanoscale science. May be repeated for credit. *(On demand)*

NANO 8101. Introduction to Instrumentation and Processing at the Nanoscale. (3) Methods of manipulating, engineering, and characterizing nanoscale materials are introduced; applications and principles of their operation are discussed. Students acquire hands-on experience with selected laboratory methods in preparation for dissertation research. Topics include, but are not limited to, scanning probe and electron microscopy methods, cleanroom technology, nanoscale optical and e-beam lithography, nuclear magnetic resonance, mass spectrometry, luminescence methods, interferometry, gel permeation chromatography, surface area analysis, and small-angle x-ray and neutron scattering. *(Fall)*

NANO 8102. Nanoscale Phenomena. (3) Topics include, but are not limited to, scaling phenomena; nano-optics (near-field optics, limits of lithography masks, nano-dots and nanoscale optical interactions); nanoscale mechanics; nanotribology; biological and biologically-inspired machines. *(Fall)*

NANO 8103. Synthesis and Characterization of Nanomaterials. (3) Prerequisites: NANO 8101 and NANO 8102. Topics include, but are not limited to, quantum dots, metallic nanoparticles, carbon nanostructured materials and nanotubes, zeolites, organicinorganic polymers, composite materials, solution-phase colloids, sol-gel process, silica spheres, porous silicon, photonic crystals. *(Spring)*

NANO 8104. Fabrication of Nanomaterials. (3) Prerequisite: NANO 8101. Lithographic methods (CVD, PVD, e-beam, ion beam, magnetron, evaporation, spin coating, mask fabrication, developing resists); microelectromechanical systems and nanoelectromechanical systems; limits of conventional mechanical processing, electroforming, growth mechanisms (organic, inorganic, thermal); powders. *(Spring)*

NANO 8201. Research Group Rotations. (1) Students interact on a regular basis with selected research groups in nanoscale science from at least three different departments at UNC Charlotte. Specific activities range from meeting with the group's professor and/or other group members, attending group meetings, and observing laboratory experiments and procedures. Research groups are chosen so that each student is exposed to an array of research activities of the Nanoscale Science faculty. At the end of each rotation, the visiting student delivers a presentation to the visited research group, describing what the student learned about the visited group's research activities. *(Fall)*

NANO 8202. Interdisciplinary Team Project. (2) Corequisite: NANO 8682. An encapsulated, semester-long research experience designed to introduce students to laboratory work in nanoscale science. Students work, in interdisciplinary teams of 2-4 students, on a short research project and present their results during a meeting of the Nanoscale Science Colloquium. *(Spring)*

NANO 8203. Collaborative Research Proposal. (3) Effective strategies for designing and writing research proposals are presented by program faculty members, and staff from proposal development offices on campus. Students work in teams of 2-3 to prepare an original, interdisciplinary research proposal on a topic in nanoscale science. The proposal conforms to regulations of a selected funding agency and must address a topic that is supported by that agency. Each team consults regularly with a panel of 2-3 faculty members who collectively approve the proposal topic, provide feedback during the development of the proposal, and ultimately evaluate the proposal. The course is designed to increase the ability of students to relate research ideas to fundamental concepts in science and engineering, to help students learn to develop effective methods of presenting ideas and defending them, to help students develop self confidence in their abilities to present and defend ideas, and to improve oral and written communication skills. *(Spring)*

NANO 8681. Nanoscale Science Seminar. (1) Students attend weekly seminars of visiting speakers of the Nanoscale Science program or other approved programs on campus. Seminars are selected to best meet the educational needs of the individual student. Students submit for grading summaries of the seminars attended. (May be repeated for credit) *(Fall/Spring)*

NANO 8682. Nanoscale Science Colloquium. (1) Students present seminars on current topics in nanoscale science to the faculty and student participants of the program.

Presentations address dissertation research, the current literature, group projects, and special topics. The colloquium provides an opportunity for students to discuss topics in Nanoscale Science with faculty from all of the participating disciplines. (May be repeated for credit) *(Fall/Spring)*

NANO 8900. Dissertation Research. (1-8) Research for the dissertation. (May be repeated for credit) *(Fall/Spring/Summer)*

NANO 9999. Doctoral Degree Graduate Residency Credit. (1) Prerequisite: NANO 8900. Required of all Nanoscale Science Ph.D. students who have completed all requirements for the degree except the dissertation defense and are taking no other courses. May be repeated for credit. Credit for this course does not count toward the degree. *(Fall/Spring/Summer)*

B. Justification.

1. Identify the need addressed by the proposal and explain how the proposed action meets the need.

The proposal meets the need to officially establish the core courses of the Nanoscale Science Ph.D. program (the program began in fall 2007). The proposal also addresses the need to establish a special topics course for the Nanoscale Science Ph.D. program. The special topics course will allow faculty to offer courses on current topics in nanoscale science that address the needs of particular students.

2. Discuss the prerequisites/corequisites for course(s) including class standing.

The prerequisites/co-requisites for the core courses were chosen to (1) ensure that students have the background necessary to succeed in the courses, and (2) ensure that students have the background needed to participate in team projects in the courses. The NANO curriculum is highly integrated, and the courses were designed to be taken in a specific sequence.

Students are normally admitted to the Nanoscale Science Ph.D. program for the fall semester. During their first fall semester, they enroll in the following courses:

NANO 8001. Perspectives at the Nanoscale (2)
NANO 8101. Intro to Instrumentation and Processing at the Nanoscale (3)
NANO 8102. Nanoscale Phenomena (3)
NANO 8201. Research Group Rotations (1)
NANO 8681. Nanoscale Science Seminar (1)

During their second semester (spring of year 1), students enroll in the courses indicated below:

NANO 8103. Synthesis of Nanomaterials (3)
NANO 8104. Fabrication of Nanomaterials (3)
NANO 8202. Interdisciplinary Team Project (2)

NANO 8681. Nanoscale Science Seminar (1)
NANO 8682. Nanoscale Science Colloquium (1)

NANO 8101 (Instrumentation) is a prerequisite course for NANO 8103 (Synthesis) and 8104 (Fabrication). NANO 8103 teaches students how common nanomaterials are synthesized and characterized. Understanding how nanomaterials are characterized requires knowledge of the instrumentation used for characterization, which is the material taught in NANO 8101. NANO 8104 teaches students how to fabricate nanomaterials and likewise requires an understanding of methods used to characterize nanomaterials.

NANO 8102 (Nanoscale Phenomena) is a prerequisite for NANO 8103. The synthesis of nanomaterials requires an understanding of what is special about the nanoscale, thereby requiring NANO 8102 as a prerequisite for NANO 8103.

NANO 8682 (Colloquium) is a corequisite for NANO 8202 (Interdisciplinary Team Project). Students in NANO 8202 are required to present the results of their project in NANO 8682, which justifies the need for the corequisite.

NANO 8900 (Dissertation Research) is a prerequisite for NANO 9999 (Graduate Residency Credit). Students only enroll in this course when they have completed all other requirements for the degree, including dissertation research.

The prerequisite "permission of the instructor" for NANO 8060 is to ensure that students have the background needed to succeed in the course.

3. **Demonstrate that course numbering is consistent with the level of academic advancement of students for whom it is intended.**
The NANO courses are intended for doctoral students, hence the numbering is consistent with the level of academic advancement of students for whom it is intended.

4. **In general, how will this proposal improve the scope, quality and/or efficiency of programs and/or instruction?**
The core courses are needed for the Nanoscale Science Ph.D. program. These are the same courses included in the proposal to establish the Ph.D. program in Nanoscale Science, approved by the UNC Board of Governors in January, 2007. The special topics course (NANO 8060) will allow the faculty to offer, on a trial basis, new courses that are not officially part of the curriculum. Should a particular special topics course prove successful and be in high demand, it will be proposed as a "permanent" course for the program and will go through the University's curriculum approval process.

C. Impact.

1. **What group(s) of students will be served by this proposal? Describe how you determined which students will be served.**
Students enrolled in the Nanoscale Science Ph.D. program are required to take all of the courses presented in this proposal, with the exception of Special Topics in Nanoscale Science (NANO 8060). In addition, students enrolled in other doctoral (OPTI, ECE, MEES) and Master's (CHEM, OPTI, ECE, MEES) programs may be served by courses in this proposal, as evidenced by the fact that students have already enrolled in these courses.

2. **What effect will this proposal have on existing courses and curricula?**
a. When and how often will the course be taught?

NANO 8001. Perspectives at the Nanoscale. (2)
Yearly, fall semesters
NANO 8060. Special Topics in Nanoscale Science. (1-3)
On demand
NANO 8101. Intro to Instrumentation and Processing at the Nanoscale. (3)
Yearly, fall semesters
NANO 8102. Nanoscale Phenomena. (3)
Yearly, fall semesters
NANO 8103. Synthesis and Characterization of Nanomaterials. (3)
Yearly, spring semesters
NANO 8104. Fabrication of Nanomaterials. (3)
Yearly, spring semesters
NANO 8201. Research Group Rotations. (1)
Yearly, fall semesters
NANO 8202. Interdisciplinary Team Project. (2)
Yearly, spring semesters
NANO 8203. Collaborative Research Proposal. (3)
Yearly, spring semesters
NANO 8681. Nanoscale Science Seminar. (1)
Every fall and spring semester
NANO 8682. Nanoscale Science Colloquium. (1)
Every fall and spring semester
NANO 8900. Dissertation Research. (1-8)
Every fall, spring and summer
NANO 9999. Doctoral Degree Graduate Residency Credit. (1)
Every fall, spring and summer

b. How will the content and/or frequency of offering of other courses be affected?
The content and/or frequency of offering other courses will not be

affected. The core courses are required for the Nanoscale Science Ph.D. program. The special topics course will be offered when there is demand for the course.

c. **What is the anticipated enrollment in course(s) added (for credit and auditors)?**

NANO 8001	3-10
NANO 8101	3-10
NANO 8102	3-10
NANO 8103	3-10
NANO 8104	3-10
NANO 8201	3-10
NANO 8202	3-10
NANO 8203	3-10
NANO 8681	13-40
NANO 8682	13-40
NANO 8900	13-40

d. **How will enrollment in other courses be affected? How did you determine this?**

Enrollment in other courses will not be affected because this is a new degree program.

e. **If course(s) have been offered previously under special topic(s) numbers, give details of experience including number of times taught and enrollment figures.**
The courses have been offered by special permission with the following enrollment figures:

Course	F2007	S2008	F2008	S2009	F2009	S2010	F2010
NANO 8001	9	-	3	-	3	-	5
NANO 8101	11	-	5	-	7	-	6
NANO 8102	14	-	4	-	7	-	6
NANO 8103	-	11	-	6	-	4	-
NANO 8104	-	10	-	3	-	3	-
NANO 8201	6	-	5	-	3	-	4
NANO 8202	-	7	-	3	-	3	-

NANO 8203	-	-	-	7	-	5	-
NANO 8681	10	10	13	11	13	13	16
NANO 8682	-	10	10	11	10	13	12
NANO 8900	-	8	16	16	17	15	12

f. **Identify other areas of catalog copy that would be affected, e.g., curriculum outlines, requirements for the degree, etc.**
The proposal will affect the "requirements for the degree" section of the Nanoscale Science catalog copy.

D. Resources required to support proposal

1. Personnel
   a. Requirements for new faculty, part-time teaching, student assistant and/or increased load on present faculty.
   The courses are taught by existing faculty in the departments of Chemistry, Electrical and Computer Engineering, Mechanical Engineering and Engineering Science, Physics and Optical Science, and Biology

   b. Qualified faculty interested in teaching the courses

NANO 8001: Bernadette Donovan-Merkert, any faculty member in the program

NANO 8060: Marcus Jones, any faculty member in the program

NANO 8101: Patrick Moyer, Thomas Schmedake, Terry Xu, Bernadette Donovan-Merkert

NANO 8102: Patrick Moyer, Jordan Poler, Tsinghua Her

NANO 8103: Thomas Schmedake, Terry Xu

NANO 8104: Ed Stokes, Stuart Smith, Terry Xu

NANO 8201: Bernadette Donovan-Merkert

NANO 8202: Jordan Poler, Terry Xu, Marcus Jones, any faculty member in the program

NANO 8203: Michael Fiddy, Jordan Poler, any faculty member in the program

NANO 8681: Bernadette Donovan-Merkert, Ed Stokes, any faculty member in the program

NANO 8682: Bernadette Donovan-Merkert, Marcus Jones, any faculty member in the program

2. Physical Facility – none (adequate facilities are available)

3. Equipment and supplies – adequate equipment exists on campus; the program operating budget will cover any supplies or instrument user fees needed for courses.

4. No new computer resources are required.

5. No new audio/visual equipment is required.

6. No other resources are required

7. No new funding is required. The program operating budget contains funding to cover the materials/user fees needed for the courses.

E. Consultation with the Library and Other Departments or Units

1. Library Consultation
Ms. Barbara Tierney completed an analysis of Atkins Library resources in the area of Nanoscale Science with regard to journals, indexes and databases, reference books and circulating books, and found that the Library collection is adequate to support our Nanoscale Science Ph.D program. Ms. Tierney's analysis is attached.

2. Consultation with other departments or units
Supporting letters for the Nanoscale Science Ph.D. Request to Establish proposal were provided by department chairs from the departments of Biology, Electrical and Computer Engineering, Mechanical Engineering and Engineering Science, and Physics and Optical Science. These letters are attached. Faculty from Chemistry, Electrical and Computer Engineering, Mechanical Engineering and Engineering Science, and Physics and Optical Science, have taught courses in the existing NANO curriculum, thereby providing further evidence of support by these departments. Faculty from all five participating departments have served as guest speakers in the Perspectives at the Nanoscale course (NANO 8001). Updated letters will be provided upon request.

F. Initiation and Consideration of the Proposal

1. Originating unit
Nanoscale Science Ph.D. program and Department of Chemistry (Bernadette

Donovan-Merkert)

2. Other Considering Units
Departments of Biology, Electrical and Computer Engineering, Mechanical Engineering and Engineering Science, Physics and Optical Science

G. Attachments

1. Letters of support

2. Course syllabi

3. Library analysis

Donovan-Merkert, Bernadette

From: Knoblauch, Cy
Sent: Monday, February 14, 2011 9:49 AM
To: Donovan-Merkert, Bernadette
Subject: RE: Proposal NANO 04-29-2010

Hi Bernadette

The Biology Department reconfirms its support for the Nanoscale Science PhD program, including the core courses and Special Topics course identified in your attachment.

Cy Knoblauch
Interim Chair

UNC CHARLOTTE

The WILLIAM STATES LEE COLLEGE *of* ENGINEERING

Department of Electrical and Computer Engineering

9201 University City Boulevard, Charlotte, NC 28223-0001
t/ 704-687-8593 f/ 704-687-4762 www.ece.uncc.edu

May 23rd 2011

Bernadette T. Donovan-Merkert,
Professor and Chair of Chemistry
Acting Director, Nanoscale Science Ph.D. Program

Dear Bernadette

The Department of Electrical and Computer Engineering reconfirms its support for the Nanoscale Science Ph.D. program, including the core courses and special topics course identified in your attachment.

It has been pleasure since joining UNC Charlotte to interact with you, other faculty and the students involved in this program and I am happy to continue to support it.

Yours Sincerely

Ian Ferguson
Professor and Chair
Electrical and Computer Engineering

Donovan-Merkert, Bernadette

From: Scott Smith [kssmith@uncc.edu]
Sent: Monday, June 13, 2011 10:40 AM
To: Donovan-Merkert, Bernadette
Subject: Letter of support needed for Nanoscale Science courses

Dear Bernadette,

The Department of Mechanical Engineering and Engineering Science reconfirms its support for the Nanoscale Science Ph.D. program, including the core courses and the special topics course identified in your attachment.

Best Regards,

Scott

--

Scott Smith | Professor and Chair
UNC Charlotte | Dept. of Mechanical Engineering
9201 University City Blvd. | Charlotte, NC 28223
Phone: 704-687-8350 | Fax: 704-687-8345
kssmith@uncc.edu | http://www.uncc.edu

UNC CHARLOTTE
The University of North Carolina at Charlotte
9201 University City Boulevard
Charlotte, NC 28223-0001

Department of Physics
704 / 687-8136
Fax: 704 / 687-8197

MEMORANDUM

To: Professor Bernadette Donovan-Merkert, Chair, Department of Chemistry
From: Patrick Moyer, Interim Chair, Department of Physics and Optical Science
Date: 16 May 2011
Re: Nanoscale PhD program course curriculum

Please accept this letter as my strong support for the course curriculum of the Nanoscale PhD program. Our Department has benefited directly from the course curriculum and students of the Nanoscale PhD program. Our faculty members have benefited since many of the current Nanoscale PhD program students are working in the laboratories of our faculty. There are a number of our faculty members who serve as primary dissertation advisors for Nanoscale PhD graduate students. In addition, our faculty members have been eager to teach courses in the program. Finally, many of our Optical Science and Engineering (OSE) PhD students benefit from the course offerings in the Nanoscale Science PhD program. In short, the synergy between our two respective programs is in excellent support of the interdisciplinary vision of UNC Charlotte and I know that our students and faculty look forward to a continued collaboration between the two programs.

Patrick J. Moyer

Patrick J. Moyer
Associate Professor and Interim Chair
Department of Physics and Optical Science

The University of North Carolina *is composed of the sixteen public senior institutions in North Carolina*
An Equal Opportunity/Affirmative Action Employer

NANO 8001 **Perspectives at the Nanoscale** **Fall (YEAR)**

Syllabus

1. **Course Number and Title:** NANO 8001 Perspectives at the Nanoscale

2. **Catalog Description of the Course**
NANO 8001 Perspectives at the Nanoscale. (2) NANO program faculty members present and discuss their research in nanoscale science to: (1) demonstrate how scientists and engineers from different disciplines approach problem-solving at the nanoscale, and (2) expose students to research opportunities for dissertation work. Students write summaries of the presentations. *(Fall)*

3. **Pre- or Co-requisites:** None

4. **Objectives of the course**
The objectives of the course are for students to (1) understand how scientists and engineers from different disciplines approach problem solving at the nanoscale; (2) identify potential faculty mentors for dissertation work, and (3) write clear, concise summaries that demonstrate an understanding of the research presented. Students are expected to attend every class, maintain a seminar notebook, and write summaries for each presentation.

5. **Instructional Method**
This is a lecture course in which faculty present lectures on their research. Students maintain a notebook on the presentations and write short (1-2 page) summaries on the research presented.

6. **Means of student evaluation**
The course grade is based on the following assessments:

Presentation write-ups (due weekly)	80%
Notebook (submitted during Week 4 and Week 15)	10%
Final paper	10%
Total	**100%**

All written work will be graded for content, clarity, conciseness, and mechanics (grammar, punctuation, etc.).

7. **Specify policies that apply to this course:**
   a. **Academic integrity**
   All UNC Charlotte students have the responsibility to be familiar with and to observe the requirements of The UNC Charlotte Code of Student Academic Integrity (available online at http://www.legal.uncc.edu/policies/ps-105.html). This Code forbids cheating, fabrication or falsification of information, multiple submission of academic work, plagiarism, abuse of academic materials (such as Library books on reserve), and complicity in academic dishonesty (helping others to violate the Code). Any further specific requirements or permission regarding academic integrity in this course will be stated by the instructor, and are also binding on the students in this course. Students

who violate the Code can be punished to the extent of being permanently expelled from UNC Charlotte and having this fact recorded on their official transcripts. Standards of academic integrity will be enforced in this course. Students are expected to report cases of academic dishonesty they become aware of to the course instructor.

b. Attendance

Each instructor determines the attendance regulations for his or her own class. Students are expected to attend all scheduled sessions punctually and are responsible for completing the work from every class meeting. Absences from class may be excused by the instructor for personal illness, religious holidays, or participating as an authorized University representative in an out-of-town event. Whenever possible, students are expected to seek the permission of the instructor prior to absences. Unexcused absences may result in a lowering of the final course grade.

c. Grading Policy

A	85-100%
B	70-84%
C	50-69%
U	below 50%

d. Classroom climate

UNC Charlotte strives to create an academic climate in which the dignity of all individuals is respected and maintained. The university celebrates diversity that includes, but is not limited to, ability/disability, age, culture, ethnicity, gender, language, race, religion, sexual orientation, and socio-economic status. The instructor expects you to attend every class punctually, participate in class discussions, and treat every member of the class with respect.

e. Religious accommodation

UNC Charlotte provides reasonable accommodations for students who have religious obligations that conflict with exams, class meetings, or other course activities (see Policy #134 Religious Accommodation for Students at http://legal.uncc.edu/policies/ps-134.html). Students who plan to be absent due to religious observance must submit to their instructor a Request for Religious Accommodation form (http://legal.uncc.edu/sites/legal.uncc.edu/files/media/policies/ps-134-AccommodationForm.pdf) prior to the census date for enrollment for a given semester. The census date for each semester (typically the tenth day of instruction) can be found on UNC Charlotte's academic calendar.

8. Probable textbooks or resources

Robinson, M.S.; Stoller, F.L.; Costanza-Robinson, M.S.; Jones, J.K. *Write Like a Chemist* Oxford University Press: New York, 2008.

Web of Science

9. Topical outline of course content

1. Some perspectives on nanoscale science and engineering
2. Literature resources available through Atkins Library
3. Effective ways to communicate about science and engineering
4. Faculty research presentations

Speaker (Affiliation)	Topic
Andriy Baumketner (PHYS)	*Amyloid fibrils as biological materials at nanoscale: theoretical perspective*
Bernadette Donovan-Merkert (CHEM)	*Electrochemistry of nanoscale materials*
Ahmed El-Ghannam (MEES)	*Nano bioactive ceramic composites: Applications in the biomedical field*
Markus Etzkorn (CHEM)	*Fluorinated Molecular Scaffolds: From Small Building Blocks to Molecular Tweezers and Supramolecular Connecting Units*
Faramarz Farahi (PHYS)	*Applications of nano-particles in optical sensors and solar energy harvesting*
Ian Ferguson (ECE)	*Is nano technology?*
Mike Fiddy	*Metamaterials*
Greg Gbur (PHYS)	*Surface plasmon effects in nano-optics*
Tsing-Hua Her (PHYS)	*Seeing molecules through clouds: a new molecular imaging technique based on excitation modulation*
Bob Hocken (CPM)	*Nanopositioning over macroscopic distances*
Ana Jofre (PHYS)	*Upconversion of infrared radiation using gold nanorods*
Marcus Jones (CHEM)	*Exploring electron transfer dynamics in semiconductor nanocrystals*
Joanna Krueger (CHEM)	*Small-angle scattering: Solutions for the evaluation of nanoscale structure*
Pat Moyer (PHYS)	*Fluorescence imaging and spectroscopy at the single molecule level*
Yuri Nesmelov (PHYS)	*Myosin molecular motor structural kinetics*
Jordan Poler (CHEM)	*Fundamental understanding of interactions at the nanoscale leads to control over matter at the macroscale*
Amy Ringwood (BIOL)	
Tom Schmedake (CHEM)	*Developing nanoscale photocatalysts for converting CO_2 into a renewable fuel*
Ed Stokes (ECE)	*Quantum dot optoelectronic devices*
Stuart Smith (MEES)	*Precision engineering at the nanoscale*
Jay Troutman (CHEM)	*A biochemist's view of nanoscale science*
Michael Walter (CHEM)	*Solar water splitting*
Qiuming Wei (MEES)	*Nanocrystalline materials*
Terry Xu (MEES)	*Boron-based one-dimensional nanostructures: synthesis and characterization*
HaiTao Zhang (MEES)	*One-dimensional transition metal oxide nanostructures for*

	nanoscale smart devices
Yong Zhang (ECE)	*Emerging and future generation PV materials*

NANO 8101: Introduction to Instrumentation and Processing at the Nanoscale

Syllabus

1. **Course Number and Title:** NANO 8101 Introduction to Instrumentation and Processing at the Nanoscale

2. **Catalog Description of the Course**

   NANO 8101. Introduction to Instrumentation and Processing at the Nanoscale. (3) Methods of manipulating, engineering, and characterizing nanoscale materials are introduced; applications and principles of their operation are discussed. Students acquire hands-on experience with selected laboratory methods in preparation for dissertation research. Topics include, but are not limited to, scanning probe and electron microscopy methods, cleanroom technology, nanoscale optical and e-beam lithography, nuclear magnetic resonance, mass spectrometry, luminescence methods, interferometry, gel permeation chromatography, surface area analysis, and small-angle x-ray and neutron scattering. *(Fall)*

3. **Pre- or Co-requisites:** None

4. **Objectives of the course**
   The purpose of NANO 8101 is to introduce to students, through lecture presentations, instrument demonstrations and hands-on laboratory exercises some common instrumental methods used to characterize nanomaterials. Students who complete NANO 8101 should be able to do the following:

   - identify common methods used to characterize nanomaterials and indicate the information the methods provide;
   - explain, to a scientific audience, the fundamental bases upon which selected methods used for characterizing nanomaterials operate;
   - write a concise, clear description of (1) the experimental procedure(s) used to characterize a given nanomaterial, (2) the results obtained from the measurement(s) and (3) the conclusions drawn;
   - perform selected fundamental laboratory operations capably; and
   - deliver a clear, well-organized lecture on an instrumental method or process used to characterize nanomaterials, including some specific applications.

5. **Instructional Method**
   This is a combination lecture/laboratory course (two lecture hours and one laboratory hour).

6. **Means of student evaluation**
   The course grade is based on the following assessments:

Exams (three exams, weighted equally, will be administered)	40%
Laboratory (including laboratory reports and exercises, laboratory notebook, following safety protocols)	30%
In-class presentation and paper	30%
Total	**100%**

7. Specify policies that apply to this course:

a. Academic integrity

All UNC Charlotte students have the responsibility to be familiar with and to observe the requirements of The UNC Charlotte Code of Student Academic Integrity (available online at http://www.legal.uncc.edu/policies/ps-105.html). This Code forbids cheating, fabrication or falsification of information, multiple submission of academic work, plagiarism, abuse of academic materials (such as Library books on reserve), and complicity in academic dishonesty (helping others to violate the Code). Any further specific requirements or permission regarding academic integrity in this course will be stated by the instructor, and are also binding on the students in this course. Students who violate the Code can be punished to the extent of being permanently expelled from UNC Charlotte and having this fact recorded on their official transcripts. Standards of academic integrity will be enforced in this course. Students are expected to report cases of academic dishonesty they become aware of to the course instructor.

b. Attendance

Each instructor determines the attendance regulations for his or her own class. Students are expected to attend every scheduled session punctually and are responsible for completing the work for all class meetings; absence from class does not excuse the student from this responsibility. Absences from class may be excused by the instructor for personal illness, religious holidays, or participating as an authorized University representative in an out-of-town event. Whenever possible, students are expected to seek the permission of the instructor prior to absences. Unexcused absences may result in a lowering of the final course grade.

c. Grading Policy

A	85-100%
B	70-84%
C	50-69%
U	below 50%

d. Classroom climate

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e. **Religious accommodation**

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8. **Probable textbooks or resources**

Johal, M.H. *Understanding Nanomaterials* CRC Press: Boca Rotan, 2011.

9. **Topical outline of course content**

1. Introduction to instrumental methods of analysis
2. Fundamentals of laboratory work
3. Spectroscopic methods (UV-Vis, Fluorescence, IR, Raman, X-ray diffraction, NMR)
4. Imaging methods (STM, AFM, TEM)
5. Light scattering methods (Dynamic Light Scattering)
6. Miscellaneous other methods (surface area analysis, Zeta potential)

NANO 8102 **Nanoscale Phenomena** **Fall (YEAR)**

Syllabus

1. **Course Number and Title:** NANO 8102 Nanoscale Phenomena

2. **Catalog Description of the Course**

   NANO 8102. Nanoscale Phenomena. (3) Topics include, but are not limited to, scaling phenomena; nano-optics (near-field optics, limits of lithography masks, nano-dots and nanoscale optical interactions); nanoscale mechanics; nanotribology; biological and biologically-inspired machines. *(Fall)*

3. **Pre- or Co-requisites:** None

4. **Objectives of the course**
   The objective of this course is to provide students with a foundation of knowledge required for further study of nanoscale science. The course addresses unique phenomena that occur at the nanoscale, as well as lithography, scanning probe methods, nanoscale optics, carbon nanotubes, quantum dots, nanoscale electronics, molecular electronics, molecular optoelectronics, and biomolecular motors.

5. **Instructional Method**
   This is a lecture course.

6. **Means of student evaluation**
   The course grade is based on the following assessments:

Literature search project	10%
AFM/STM Project	10%
Molecule/particle interactions in solution project	10%
In class midterm exam	20%
Transport in CNTs project	10%
Quantum dots project	10%
End of term presentation	10%
End of term paper	20%
Total	**100%**

7. **Specify policies that apply to this course:**

   a. **Academic integrity**
   All UNC Charlotte students have the responsibility to be familiar with and to observe the requirements of The UNC Charlotte Code of Student Academic Integrity (available online at http://www.legal.uncc.edu/policies/ps-105.html). This Code forbids cheating, fabrication or falsification of information, multiple submission of academic work, plagiarism, abuse of academic materials (such as Library books on reserve), and complicity in academic dishonesty (helping others to violate the Code). Any further specific requirements or permission regarding academic integrity in this course will be

stated by the instructor, and are also binding on the students in this course. Students who violate the Code can be punished to the extent of being permanently expelled from UNC Charlotte and having this fact recorded on their official transcripts. Standards of academic integrity will be enforced in this course. Students are expected to report cases of academic dishonesty they become aware of to the course instructor.

b. Attendance

Each instructor determines the attendance regulations for his or her own class. Students are expected to attend every scheduled session punctually and are responsible for completing the work for all class meetings; absence from class does not excuse the student from this responsibility. Absences from class may be excused by the instructor for personal illness, religious holidays, or participating as an authorized University representative in an out-of-town event. Whenever possible, students are expected to seek the permission of the instructor prior to absences. Unexcused absences may result in a lowering of the final course grade.

c. Grading Policy

A	85-100%
B	70-84%
C	50-69%
U	below 50%

d. Classroom climate

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e. Religious accommodation

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8. Probable textbooks or resources

Di Ventra, M.; Evoy, S.; Heflin, J.R., eds. *Introduction to Nanoscale Science and Technology* Springer: New York, 2004.

9. Topical outline of course content

1. Introduction and Scaling Theory
2. Moore's Law and lithography
3. Nanolithography
4. Scanning probe techniques (AFM, STM); feedback mechanisms SPM modes
5. Molecular interactions
6. Self-assembly
7. DLVO
8. Introduction to crystallography/surfaces
9. Nanostructured carbon materials
10. Intro/review solid state physics
11. Electron and phonon transport in carbon nanotubes
12. Nanoscale electronics
13. Quantum dots
14. Quantum dot optoelectronics
15. Molecular electronics
16. Molecular optoelectronics
17. Biomolecular motors
18. Nanofluidics

NANO 8103 Synthesis and Characterization of Nanomaterials Spring (YEAR)

Syllabus

1. **Course Number and Title:** NANO 8103 Synthesis and Characterization of Nanomaterials

2. **Catalog Description of the Course**

   NANO 8103. Synthesis and Characterization of Nanomaterials. (3) Prerequisites: NANO 8101 and NANO 8102. Topics include, but are not limited to, quantum dots, metallic nanoparticles, carbon nanostructured materials and nanotubes, zeolites, organic/inorganic polymers, composite materials, solution-phase colloids, sol-gel process, silica spheres, porous silicon, photonic crystals. *(Spring)*

3. **Pre- or Co-requisites:** NANO 8101 and NANO 8102

4. **Objectives of the course**
   The objectives of this course are for students to learn how to synthesize and characterize common types of nanoparticles, including dielectric colloidal materials, semiconductor nanoparticles, metallic nanoparticles, and porous materials, and to become familiar with common types of applications of these materials.

5. **Instructional Method**
   This is a lecture course.

6. **Means of student evaluation**
   The course grade is based on the following assessments:

Problem sets	60%
Midterm	20%
Final Exam	20%
Total	**100%**

7. **Specify policies that apply to this course:**
   a. **Academic integrity**
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b. Attendance

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c. Grading Policy

A	85-100%
B	70-84%%
C	50-69%
U	below 50%

d. Classroom climate

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8. Probable textbooks or resources

Liz-Marzan, L.; Kamat, P.V., eds. *Introduction to Nanoscale Materials* Kluwer Academic/Plenum: Boston, 2003.

9. Topical outline of course content

1. Dielectric colloidal materials
2. Semiconductor nanoparticles
3. Metallic nanoparticles
4. Porous materials
5. Applications – photovoltaics, solar fuels, environmental remediation, bionano

NANO 8104 **Fabrication of Nanomaterials** **Spring (YEAR)**

Syllabus

1. **Course Number and Title:** NANO 8104 Fabrication of Nanomaterials

2. **Catalog Description of the Course**

   NANO 8104. Fabrication of Nanomaterials. (3) Prerequisite: NANO 8101. Lithographic methods (CVD, PVD, e-beam, ion beam, magnetron, evaporation, spin coating, mask fabrication, developing resists); microelectromechanical systems and nanoelectromechanical systems; limits of conventional mechanical processing, electroforming, growth mechanisms (organic, inorganic, thermal); powders. *(Spring)*

3. **Pre- or Co-requisites:** NANO 8101

4. **Objectives of the course**
   Students who complete this course will be familiar with common methods of fabricating nanomaterials, including the strengths and drawbacks of these methods, through lectures and laboratory experiences.

5. **Instructional Method**
   This is a combination lecture/laboratory course.

6. **Means of student evaluation**
   The course grade is based on the following assessments:

Lab reports (4)	60%
Technical notes	15%
Term paper	15%
Power point presentation on term paper	10%
Total	**100%**

7. **Specify policies that apply to this course:**
   a. **Academic integrity**
   All UNC Charlotte students have the responsibility to be familiar with and to observe the requirements of The UNC Charlotte Code of Student Academic Integrity (available online at http://www.legal.uncc.edu/policies/ps-105.html). This Code forbids cheating, fabrication or falsification of information, multiple submission of academic work, plagiarism, abuse of academic materials (such as Library books on reserve), and complicity in academic dishonesty (helping others to violate the Code). Any further specific requirements or permission regarding academic integrity in this course will be stated by the instructor, and are also binding on the students in this course. Students who violate the Code can be punished to the extent of being permanently expelled from UNC Charlotte and having this fact recorded on their official transcripts. Standards of academic integrity will be enforced in this course. Students are expected to report cases of academic dishonesty they become aware of to the course instructor.

b. **Attendance**

Each instructor determines the attendance regulations for his or her own class. Students are expected to attend all scheduled classes punctually and are responsible for completing the work for all class meetings; absence from class does not excuse the student from this responsibility. Absences from class may be excused by the instructor for personal illness, religious holidays, or participating as an authorized University representative in an out-of-town event. Whenever possible, students are expected to seek the permission of the instructor prior to absences. Unexcused absences may result in a lowering of the final course grade.

c. **Grading Policy**

A	85-100%
B	70-84%
C	50-69%
U	below 50%

d. **Classroom climate**

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e. **Religious accommodation**

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8. **Probable textbooks or resources**

Liz-Marzan, L.; Kamat, P.V., eds. *Introduction to Nanoscale Materials* Kluwer Academic/Plenum: Boston, 2003.

9. **Topical outline of course content**

1. Langmuir-Blodgett films
2. Step height fabrication and measurement
3. Nanoimprint
4. Contact sensor lab and development
5. E-beam lithography and confocal microscopy

6. Diamond turning and polishing
7. Chemical Vapor Deposition
8. MBE (molecular beam epitaxy)

NANO 8201 **Research Group Rotations** **Fall (YEAR)**

Syllabus

1. **Course Number and Title:** NANO 8201 Research Group Rotations

2. **Catalog Description of the Course**

   NANO 8201. Research Group Rotations. (1) Students interact on a regular basis with selected research groups in nanoscale science from at least three different departments at UNC Charlotte. Specific activities range from meeting with the group's professor and/or other group members, attending group meetings, and observing laboratory experiments and procedures. Research groups are chosen so that each student is exposed to an array of research activities of the Nanoscale Science faculty. At the end of each rotation, the student delivers a presentation to the visited research group, describing what the student learned about the visited group's research activities. *(Fall)*

3. **Pre- or Co-requisites:** None

4. **Objectives of the course**
   The purpose of Research Group Rotations is to help students who are new to the Nanoscale Science Ph.D. program become reasonably familiar with research programs of some of the program's faculty. Each student is required to complete three rotations. Because Nanoscale Science is an interdisciplinary field, it is important for every student to learn how scientists and engineers from different disciplines think about nanoscale science and how they approach research. Two of each student's rotations will therefore be with faculty members who are outside of the student's undergraduate discipline to ensure that students gain a relatively broad perspective of the field.

5. **Instructional Method**
   There are no formal lectures or laboratory sessions. Learning is achieved by reading assigned papers, attending group meetings, and observing and meeting with students, faculty and other members of selected research groups. At the end of each rotation, the student makes an oral presentation on selected aspects of the group's research and how this work contributes to the overall goals of the research program.

6. **Means of student evaluation**
   Each student receives a grade at the end of each of three rotations. The course grade is an average of the three grades received.

7. **Specify policies that apply to this course:**
   a. **Academic integrity**
   All UNC Charlotte students have the responsibility to be familiar with and to observe the requirements of The UNC Charlotte Code of Student Academic Integrity (available online at http://www.legal.uncc.edu/policies/ps-105.html). This Code forbids cheating, fabrication or falsification of information, multiple submission of academic work,

plagiarism, abuse of academic materials (such as Library books on reserve), and complicity in academic dishonesty (helping others to violate the Code). Any further specific requirements or permission regarding academic integrity in this course will be stated by the instructor, and are also binding on the students in this course. Students who violate the Code can be punished to the extent of being permanently expelled from UNC Charlotte and having this fact recorded on their official transcripts. Standards of academic integrity will be enforced in this course. Students are expected to report cases of academic dishonesty they become aware of to the course instructor.

b. Attendance

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c. Grading Policy

A	85-100%
B	70-84%%
C	50-69%
U	below 50%

d. Classroom climate

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e. Religious accommodation

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8. Probable textbooks or resources

There are no textbooks for this course. Individual faculty will assign readings from the primary literature to the students.

9. Topical outline of course content

There is no course outline. Students will complete three rotations.

NANO 8203 **Collaborative Research Proposal** **Spring (YEAR)**

Syllabus

1. **Course Number and Title:** NANO 8203 Collaborative Research Proposal

2. **Catalog Description of the Course**

   NANO 8203. Collaborative Research Proposal. (3) Effective strategies for designing and writing research proposals are presented by program faculty members, and staff from proposal development offices on campus. Students work in teams of 2-3 to prepare an original, interdisciplinary research proposal on a topic in nanoscale science. The proposal conforms to regulations of a selected funding agency and must address a topic that is supported by that agency. Each team consults regularly with a panel of 2-3 faculty members who collectively approve the proposal topic, provide feedback during the development of the proposal, and ultimately evaluate the proposal. The course is designed to increase the ability of students to relate research ideas to fundamental concepts in science and engineering, to help students learn to develop effective methods of presenting ideas and defending them, to help students develop self confidence in their abilities to present and defend ideas, and to improve oral and written communication skills. *(Spring)*

3. **Pre- or Co-requisites:** None

4. **Objectives of the course**
   The objective of this course is to study grant writing techniques and review criteria used by funding agencies to evaluate grant proposals. Each student will develop a research proposal, but within the group these proposals will be directed toward a common collaborative theme. Draft proposals will be developed and the intent is to combine these into a single collaborative but multifaceted proposal to submit to agencies for comment. Students will have the opportunity to work together on this unified proposal and develop an appreciation for interdisciplinary collaborative research. There will also be opportunities to critique each others' contributions as a reviewer and present the proposal to a panel of faculty for their constructive feedback. Each student will be graded individually based on their efforts.

5. **Instructional Method**
   The class will consist of a combination of seminar presentations made by faculty and guest speakers, discussion meetings, and panel review sessions.

6. **Means of student evaluation**
   The course grade is based on the following assessments:

Proposal – Draft 1	15%
Proposal Draft 1 presentation	15%
Proposal Draft 1 critique	10%
Panel presentation	20%
Final (revised) proposal	30%

Final proposal critique	10%
Total	**100%**

7. **Specify policies that apply to this course:**

a. **Academic integrity**

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b. **Attendance**

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c. **Grading Policy**

A	85-100%
B	70-84%%
C	50-69%
U	below 50%

d. **Classroom climate**

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e. **Religious accommodation**

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8. Probable textbooks or resources

Handouts provided by the instructor

Robinson, M.S.; Stoller, F.L.; Costanza-Robinson, M.S.; Jones, J.K. *Write Like a Chemist* Oxford University Press: New York, 2008.

9. Topical outline of course content

1. How to find possible agencies to fund your research
2. What makes a good proposal?
3. Protecting your ideas
4. Proposal process
5. Review process

NANO 8682 | **Nanoscale Science Colloquium** | **(Semester, Year)**

Syllabus

1. **Course Number and Title:** NANO 8682 Nanoscale Science Colloquium

2. **Catalog Description of the Course**

   NANO 8682. Nanoscale Science Colloquium. (1) Students present seminars on current topics in nanoscale science to the faculty and student participants of the program. Presentations address dissertation research, the current literature, group projects, and special topics. The colloquium provides an opportunity for students to discuss topics in Nanoscale Science with faculty from all of the participating disciplines. (May be repeated for credit) *(Fall/Spring)*

3. **Pre- or Co-requisites:** None

4. **Objectives of the course**
   The objective of this course is for students to become effective in presenting high quality seminars on topics in nanoscale science, including dissertation research, the current literature and selected topics.

5. **Instructional Method**
   The class will consist of some introductory lectures on how to develop and deliver an effective seminar presentation and weekly student seminars that are critiqued by the class.

6. **Means of student evaluation**
   The course grade is based on the following assessments:

Presentation	60%
Class participation	40%
Total	**100%**

7. **Specify policies that apply to this course:**
   a. **Academic integrity**
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c. **Grading Policy**

A	85-100%
B	70-84%%
C	50-69%
U	below 50%

d. **Classroom climate**

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8. **Probable textbooks or resources**

Handouts provided by the instructor

9. **Topical outline of course content**

1. Introductory lectures on how to deliver an effective seminar
2. Student presentations and seminar critiques

J. MURREY ATKINS LIBRARY
LIBRARY CONSULTATION FOR
COURSE AND/OR CURRICULUM PROPOSAL

Date: February 25, 2010

To: Dr. Bernadette Donovan-Merkert, Chair
Chemistry Department

From: Barbara Tierney, Library Liaison to the Department of Chemistry

A. Proposal Summary

This proposal is being made to officially establish the core courses needed for the Nanoscale Science Ph.D. program. The program began in Fall 2007.

The Nanoscale Science core courses include the following:

- **NANO 8001. Perspectives at the Nanoscale. (2)**
- **NANO 8101. Introduction to Instrumentation and Processing at the Nanoscale. (3)**
- **NANO 8102. Nanoscale Phenomena. (3)**
- **NANO 8103. Synthesis and Characterization of Nanomaterials. (3)**
- **NANO 8104. Fabrication of Nanomaterials. (3)**
- **NANO 8201. Research Group Rotations. (1)**
- **NANO 8202. Interdisciplinary Team Project. (2)**
- **NANO 8203. Collaborative Research Proposal. (3)**
- **NANO 8681. Nanoscale Science Seminar. (1)**
- **NANO 8682. Nanoscale Science Colloquium. (1)**
- **NANO 8900. Dissertation Research. (1-8)**
- **NANO 9999. Doctoral Degree Graduate Residency Credit. (1)**

Library Collection Evaluation:

The adequacy of library holdings to support the above Nanoscale Science Ph.D program core courses is evaluated by the Reference Librarian as follows:

1. Holdings are superior: ______________________________
2. **Holdings are adequate:** ___X___________________________
3. Holdings are adequate only if department purchases additional materials: ______________________________
4. Holdings are inadequate: ______________________________

Comments:

Science Liaison Librarian Barbara Tierney has completed a thorough evaluation of Atkins Library resources with regard to journals, databases and indexes, reference resources, and circulating books that are relevant to the Nanoscale Science Ph.D program. Ms. Tierney finds that the Library has sufficient resources to support this new program. **Please see the following Summary Tables for detailed Library holdings information.**

Journals:
ISI's "Journal Citation Reports" lists a total of fifty selected Nanoscience journal titles (listed below in "impact factor" order) on which it collects data. Atkins Library has access to thirty-four out of the fifty titles (or 68%). The titles to which Atkins has access are indicated by a check-mark in the first column. Individual journal articles that are not available in-house may be requested through the Library's Interlibrary Loan Service.

Mark	Rank	Abbreviated Journal Title *(linked to journal information)*	ISSN	JCR Data						*Eigenfactor*™ Metrics	
				Total Cites	Impact Factor	5-Year Impact Factor	Immediacy Index	Articles	Cited Half-life	*Eigenfactor*™ Score	*Article Influence*™ Score
☐	1	NAT NANOTECHNOL	1748-3387	2927	20.571	20.588	5.097	93	1.6	0.02936	11.131
☑	2	NANO LETT	1530-6984	37089	10.371	12.189	1.524	817	3.7	0.25290	4.492
☑	3	NANO TODAY	1748-0132	376	8.795	9.231	1.077	13	1.8	0.00283	3.278
☑	4	SMALL	1613-6810	5016	6.525	7.292	0.856	319	2.5	0.03700	2.580
☐	5	LAB CHIP	1473-0197	6369	6.478	7.000	0.978	279	3.1	0.03258	1.885
☑	6	NANOMEDICINE-UK	1743-5889	567	6.093	6.093	0.768	56	1.7	0.00355	1.862
☑	7	ACS NANO	1936-0851	703	5.472	5.472	1.389	296	0.9	0.00214	1.825
☑	8	BIOSENS BIOELECTRON	0956-5663	12112	5.143	5.330	0.716	341	4.0	0.04866	1.376
☐	9	NANOTOXICOLOGY	1743-5390	101	3.720	3.720	0.444	18	1.5	0.00047	0.856
☑	10	PLASMONICS	1557-1955	158	3.488	3.512	0.333	21	1.9	0.00109	1.147
☑	11	NANOTECHNOLOGY	0957-4484	16291	3.446	3.727	0.507	1397	2.9	0.09885	1.233
☑	12	J PHYS CHEM C	1932-7447	10392	3.396	3.398	0.579	2888	1.4	0.06517	1.149
☑	13	MICROFLUID NANOFLUID	1613-4982	783	3.314	4.194	0.827	133	2.3	0.00434	1.224
☑	14	BIOMED MICRODEVICES	1387-2176	1208	2.924	3.368	0.558	95	3.8	0.00534	0.934
☑	15	SCRIPTA MATER	1359-6462	13399	2.887	3.004	0.540	593	4.9	0.07118	1.215
☑	16	MICROPOR MESOPOR MAT	1387-1811	9083	2.555	3.237	0.426	660	4.7	0.03130	0.842
☐	17	CURR NANOSCI	1573-4137	278	2.437	2.760	0.255	51	2.6	0.00177	0.832
☑	18	BIOMICROFLUIDICS	1932-1058	57	2.318	2.318	0.375	16		0.00032	0.652
☐	19	J NANOPART RES	1388-0764	1806	2.299	3.118	0.476	170	4.0	0.00900	1.015
☐	20	J MICROMECH MICROENG	0960-1317	6387	2.233	2.811	0.291	405	4.3	0.02643	0.776

Mark	Rank	Abbreviated Journal Title *(linked to journal information)*	ISSN	JCR Data						*Eigenfactor*™ Metrics	
				Total Cites	Impact Factor	5-Year Impact Factor	Immediacy Index	Articles	Cited Half-life	*Eigenfactor*™ Score	*Article Influence*™ Score
☐	21	IEEE T NANOTECHNOL	1536-125X	1447	2.154	2.583	0.276	116	3.7	0.01002	1.014
☑	22	PHOTONIC NANOSTRUCT	1569-4410	276	1.940		1.594	32	2.8	0.00152	
☐	23	J NANOSCI NANOTECHNO	1533-4880	4293	1.929	2.100	0.196	1011	2.6	0.02214	0.551
☑	24	MAT SCI ENG A-STRUCT	0921-5093	28176	1.806	2.201	0.317	1816	5.6	0.11083	0.748
☑	25	NANOSCALE RES LETT	1931-7573	207	1.731	1.731	0.318	85	1.6	0.00130	0.566
☑	26	IEE P-NANOBIOTECHNOL	1478-1581	179	1.700	3.978		0	3.7	0.00118	1.182
☑	27	INT J NANOMED	1176-9114	227	1.642	1.649	0.167	36	2.1	0.00115	0.386
☑	28	MICROELECTRON ENG	0167-9317	5515	1.583	1.573	0.228	486	4.2	0.02815	0.528
☑	29	IET NANOBIOTECHNOL	1751-8741	25	1.562	1.563	0.000	10		0.00017	0.468
☑	30	J VAC SCI TECHNOL B	1071-1023	11006	1.445	1.547	0.329	465	7.4	0.03333	0.529
☑	31	IEEE T NANOBIOSCI	1536-1241	470	1.341	2.233	0.121	33	4.1	0.00249	0.583
☐	32	MICROELECTRON RELIAB	0026-2714	2774	1.290	1.182	0.120	275	4.8	0.01087	0.347
☐	33	J COMPUT THEOR NANOS	1546-1955	486	1.256		0.205	288	2.2	0.00285	
☑	34	PHYSICA E	1386-9477	3751	1.230	1.000	0.261	729	4.3	0.02108	0.384
☑	35	MICROSYST TECHNOL	0946-7076	1242	1.229	1.120	0.124	259	3.8	0.00526	0.316
☑	36	J MICROLITH MICROFAB	1537-1646	287	1.217	1.024		0	3.8	0.00180	0.326
☐	37	INT J NANOTECHNOL	1475-7435	230	1.184		0.214	70	2.9	0.00150	
☐	38	NANO	1793-2920	87	1.110	1.110	0.094	64		0.00050	0.312
☑	39	J EXP NANOSCI	1745-8080	67	1.103	1.138	0.048	21		0.00051	0.398
☐	40	J MICRO-NANOLITH MEM	1537-1646	76	1.067	1.100	0.082	73		0.00053	0.399

Mark	Rank	Abbreviated Journal Title *(linked to journal information)*	ISSN	JCR Data						*Eigenfactor*™ Metrics	
				Total Cites	Impact Factor	5-Year Impact Factor	Immediacy Index	Articles	Cited Half-life	*Eigenfactor*™ Score	*Article Influence*™ Score
☑	41	NANOSC MICROSC THERM	1556-7265	54	1.000	1.020	0.067	15		0.00045	0.394

☑	42	PRECIS ENG	0141-6359	1019	0.895	1.348	0.395	38	8.6	0.00235	0.429
☐	43	REV ADV MATER SCI	1606-5131	498	0.891		0.045	154	3.9	0.00380	
☑	44	MICROELECTRON J	0026-2692	1315	0.859	0.848	0.047	361	4.4	0.00633	0.282
☑	45	MICRO NANO LETT	1750-0443	46	0.849	0.849	0.091	11		0.00036	0.309
☑	46	J NANOMATER	1687-4110	50	0.688		0.066	91		0.00030	
☑	47	FULLER NANOTUB CAR N	1536-383X	219	0.680	0.550	0.066	91	3.4	0.00137	0.176
☐	48	MICRO	1081-0595	117	0.586	0.422		0	6.1	0.00014	0.045
☐	49	SYNTH REACT INORG M	1553-3174	1224	0.545	0.729	0.049	144	7.3	0.00221	0.159
☑	50	J SURF INVESTIG-X-RA	1027-4510	17	0.478	0.565	0.000	171		0.00010	0.204

Atkins Library Selected Indexes and Databases Relevant to Nanoscience

The following table gives a listing of selected indexes and databases relevant to Nanoscience to which Atkins Library has access

Atkins Library Indexes & Databases relevant to Nanoscience
Aluminum Industry Abstracts
Bioengineering Abstracts
Biotechnology Abstracts
Ceramic Abstracts/World Ceramics Abstracts
Compendex
Conference Papers Index
CRC Engineering Handbooks (electronic)
Electronics & Communications Abstracts
Engineered Materials Abstracts
IEEE Xplore
Institute of Physics

Materials Business File
Mechanical Engineering Abstracts
METADEX
MicroPatent Materials Patents
Science Direct (Elsevier electronic journals)
SciFinder Scholar (electronic Chem.Abstracts)
Scitation
Solid State and Superconductivity Abstracts
Springer-Verlag Link (Springer-Verlag electronic journals)
U.S. Patents
Web of Science
Wiley Interscience

Atkins Library selected reference books relevant to Nanoscience
The following is a selected list of reference books relevant to Nanoscience which are available in the First Floor Reference Collection

AUTHOR Schramm, Laurier Lincoln.
TITLE Dictionary of nanotechnology, colloid and interface science / Laurier L. Schramm.
IMPRINT Weinheim : Wiley-VCH, c2008.
DESCRIPT 290 p. ; 25 cm.
1 > Reference--1st Floor T174.7 .S37 2008 NONCIRCULATING

TITLE Handbook of nanostructured biomaterials and their applications in nanobiotechnology / edited by Hari Singh Nalwa.
IMPRINT Stevenson Ranch, Calif. : American Scientific Publishers, c2005.
Vol.1-2 > Reference--1st Floor TP248.25.N35 H36 2005 v.1 NONCIRC

TITLE Handbook of nanostructured materials and nanotechnology / edited by Hari Singh Nalwa.

IMPRINT San Diego : Academic Press, c2000.
DESCRIPT 5 v. : ill. (some col.) ; 29 cm.
BIBLIOG. Includes bibliographical references and indexes.
CONTENTS v. 1. Synthesis and processing -- v. 2. Spectroscopy and theory -- v. 3. Electrical properties -- v. 4. Optical properties -- v. 5. Organics, polymers, and biological materials.
Vol.1-5 > Reference--1st Floor TA418.9.N35 H36 2000 NONCIRCULATING

TITLE Nanoscience and technology : a collection of reviews from Nature journals / edited by Peter Rodgers ; with an introduction by James Heath.
IMPRINT Singapore ; Hackensack, N.J. : World Scientific : Printed in Singapore, Mainland Press ; London, U.K. : published, Macmillan Publishers Ltd trading as Nature Pub. Group, c2010.
NOTE "Review articles ... This book brings together 35 review and progress articles from eight different 'Nature' journals"--
CONTENTS Nanomaterials and nanostructures -- Molecular machines and devices -- Nanoelectronics -- Nanophotonics -- Nanobiotechnology and nanomedicine-- Selected applications.
1 > Reference--1st Floor T174.7 .N3583 2010 NONCIRCULATING

TITLE Dekker encyclopedia of nanoscience and nanotechnology / edited by James A. Schwarz, Cristian I. Contescu, Karol Putyera.
IMPRINT New York : M. Dekker, c2004.
DESCRIPT 5 v. (xlvi, 3979, 35 p.) : ill. ; 29 cm.

Vol. 1-5 Reference--1st Floor QC176.8.N35 D43 2004 NONCIR

TITLE Encyclopedia of nanoscience and nanotechnology / editor, Hari Singh Nalwa ; [foreword by Richard E. Smalley].
IMPRINT Stevenson Ranch, Calif.: Amer.Scientific Publishers, c2004.
DESCRIPT 10 v. : ill. (some col.) ; 29 cm.
Vol. 1-10 Reference--1st Floor QC176.8.N35 E53 2004

TITLE Handbook of theoretical and computational nanotechnology / edited by Michael Rieth and Wolfram Schommers.
IMPRINT Stevenson Ranch, Calif. : American Scientific Publishers, c2006.
DESCRIPT 10 v. : ill. ; 29 cm.
CONTENTS v. 1. Basic concepts, nanomachines, and medical nanodevices -- v.2. Atomistic simulations - algorithms and methods -- v. 3. Quantum and molecular computing, quantum simulations -- v. 4. Nanomechanics and multiscale modeling -- v. 5. Transport phenomena and nanoscale processes -- v. 6. Bioinformatics, nanomedicine, and drug design -- v. 7. Magnetic nanostructures and nano-optics -- v. 8. Functional nanomaterials, nanoparticles, and polymer design -- v. 9.Nanocomposites,nano-assemblies, and nanosurfaces -- v. 10. Nanodevice modeling and nanoelectronics.
Vol. 1-10 Reference--1st Floor QC176.8.N35 H36 2006 NONCIRCULATING

TITLE Springer handbook of nanotechnology / Bharat Bhushan (ed.).EDITION 2nd rev. & extended ed.
IMPRINT Berlin ; New York : Springer, 2007.
Reference--1st Floor T174.7 .S67 2007 NONCIRCULATING

Books:
The below table shows the number of book titles that Atkins Library holds within the following relevant subject headings or keywords. The middle column shows the total number of titles held in the subject area and the far right column shows the number of titles held that are dated 2003 or newer. Individual books not available in-house may be requested through the Library's Interlibrary Loan Service.

The Atkins Library Online Catalog shows the following holdings relevant to nanoscience

Keyword/Subject Heading	Total Holdings	2003 or newer
nanotechnology (LC subject head.)	78	59
nanostructured materials (LC subject head.)	44	27
nanomaterials (LC subject head.)	42	36
nanoporous materials (keyword)	6	5
nanostructured metal composites (keyword)	6	1
nanoelectronics (LC subject head.)	4	4
nanomedicine (LC subject head.)	1	1
nanotubes (LC subject head.)	4	4
nanocatalysts (keyword)	1	1
biomolecular nanotechnology (keyword)	3	3
biopolymers (LC subject head.)	7	1
carbon nanotubes (keyword)	50	37
dendrimers (LC subject head.)	5	0
electrode surfaces (keyword)	7	4
high temperature superconductors (LC subj.head.)	17	4
molecular electronics (LC subj. head.)	17	8
molecular material hybrids (keyword)	1	0
photon confined materials (keyword)	2	2
photonic crystals (LC subject head.)	3	3
photonic devices (keyword)	81	38
quantum dots (LC subject head.)	10	7
quantum wells (LC subject head.)	15	3
spintronics (LC subject head.)	1	1
supramolecular complexes (keyword)	10	5

Conclusion:
Atkins Library Nanoscience holdings with regard to journals, databases and indexes, reference resources, and circulating books are sufficient to support this Ph.D program.

It is suggested that the participating academic departments continue ordering new resources, as they are published, in the subject areas designated above.

Barbara Tierney *Barbara Tierney* February 25, 2010

Evaluator's Signature **Date**