

## **Physics 4850B Nanomaterials Course Information: Year 2012**

### **1. Course Description**

This course will discuss the synthesis, properties characterization and applications of materials structured on the nanometer scale. The course will discuss fabrication methods including epitaxy, lithography, and self-assembly. Optical and electronic properties of nanomaterials (including zero- one- and two-dimensional nanomaterials) will be presented. Special attention will be paid to carbon-based nanomaterials, including carbon nanotubes and graphene. Other types of nanomaterials discussed include: quantum dots, nanowires and nanoparticles. The section dealing with the applications of Nanomaterials is interactive: each student will be assigned a specific type or application of nanomaterials, which will be studied individually and presented to the class in a short lecture. The course will include a visit to the Western Nanofabrication Facility (<http://www.uwo.ca/fab/>).

*Prerequisites:* Physics 2102A/B (or 2800) or 2810, and Calculus 2302A/B (or 2502A/B)

40 lecture hours, 0.5 course.

**Note:** Unless you have either the above listed prerequisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary requisites.

### **2. Timetable**

Lecture Times:

Tuesday, 2.30 – 4.30 PM / Room B&G 0153  
Thursday, 2.30 – 3.30 PM / Room B&G 0153

Instructor: Prof. Giovanni Fanchini

E-mail: [gfanchin@uwo.ca](mailto:gfanchin@uwo.ca)

Phone: (519) 661-2111 x86238

Office: PAB 229

Web Sites:

<http://www.physics.uwo.ca/~gfanchin/> (click “course notes”, left of the page)

<http://webct.uwo.ca> (Class WebCT site - UWO password required). Assignments will be posted regularly on the class WebCT site. Any errors, or appeals to your scores, must be reported to your instructor within **two weeks** of their initial posting.

### **3. Course Materials**

The following course materials can be purchased at the UWO Bookstore:

**Textbook:**

Cao, G., Wang, Y., *Nanostructures and nanomaterials: Synthesis properties and applications* (2<sup>nd</sup> ed.) World Scientific, Singapore, 2011.

(The old edition used two years ago is still relatively up to date and covers most of the subjects that will be discussed during the classes: Cao, G., *Nanostructures and nanomaterials: Synthesis properties and applications*, Imperial College Press, London, UK, 2004)

Additional materials – including the course lecture notes – will be made available on-line on the course web site (<http://www.physics.uwo.ca/~gfanchin/> - “course notes” - If you were absent at the first lecture of the course, please contact the instructor to obtain the password). Students are recommended to re-check the course lecture notes **after** the lectures, because some changes/additions may be made at that time, also for answering to questions from the audience.

#### 4. Course Content

The course content (indicative) is outlined in the following table:

<b>Week 1</b> Jan 9-13	Intro – Physics of solid surfaces and Formation of nanomaterials
<b>2</b> Jan 16-20	“Nanomaterials” versus “Bulk solids”: Analogies and differences
<b>3</b> Jan 23-27	Zero-Dimensional nanomaterials: nanoparticles Nucleation, Kinetically confined synthesis
<b>4</b> Jan 30-Feb 3	Characterization of nanoparticles: Electron microscopy, scanning probe microscopy
<b>5</b> Feb 6-10	Characterization of nanoparticles: optical properties
<b>6</b> Feb 13-17	One-Dimensional nanomaterials: Nanowires & nanorods
<b>7</b> Feb 27-Mar 2	Two-Dimensional nanomaterials: Thin films and monolayers
<b>8</b> Mar 5-9	Optical properties of thin films
<b>9</b> Mar 12-16	Carbon-based nanomaterials: Carbon nanotubes, Graphene, Nanostructured carbon
<b>10</b> Mar 19-23	Nanofabrication <i>Lectures on Specific Nanomaterials and/or their Applications</i>
<b>11</b> Mar 26-30	Solution-processing <i>Lectures on Specific Nanomaterials and/or their Applications</i>
<b>12</b> Apr 2-6	Structural characterization of Nanomaterials – Luminescence, electroluminescence <i>Lectures on Specific Nanomaterials and/or their Applications</i>
<b>13</b> Apr 9-11	Nanodevices. The lecture includes a visit to the Western Nanofabrication Facility <i>Lectures on Specific Nanomaterials and/or their Applications</i>

#### 5. Evaluation criteria

Your final grade in this course will be derived according to:

**A) Midterm assignment** (to be completed by February 29, 2012): **25%**

**B) Final assignment** (to be completed by April 11, 2012): **25%**

**C) Presentation** (based on a 10-12’ short lecture on a specific type or application of nanomaterials, presented by the student and followed by 5-7’ questions & answers): **25%**

**D) Final examination** (20 multiple-choice questions on the entire program, with 4 possible answers): **20%**  
**E) Participation: 5%**

Any errors, or appeals to your scores, must be reported to your instructor within **two weeks** of their initial posting. In rare circumstances, the Department of Physics and Astronomy reserves the right to adjust the final course marks in order to conform to Departmental policies.

## 6. Examination

### 6a Final examination: format and rules

Exam times will be posted on the course web sites when available. Students needing to make travel arrangements are advised to book a travel date after the end of the examination period. *No makeup exams will be given to accommodate travel!*

The final examination will include 20 multiple-choice questions on the entire program, with four options as possible answers. Two hours will be allowed for the student to provide the answers. This multiple-choice test may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

Calculators and any electronic devices will not be allowed during the final exam.

### 6b Presentation, including one short “lecture” by the student

Evaluation will include one presentation on one specific type or application of nanomaterials that will be studied individually. The subject of the assignment will be chosen by the instructor after individual consultation with the student. The student will be encouraged to suggest a topic of her/his own interest. It is responsibility of the student to contact the instructor and schedule an appointment (30 min max, by **February 24**) for deciding on the subject.

The subject must be presented by the student to the class in a 15-17-min seminar, using standard presentation methods such as Power Point transparencies or similar (10-12' presentation + approx. 5-7' for questions from the instructor, the teaching assistant and your colleagues).

The instructor will allocate specific time for the seminar presentations during the last weeks of the course. Attendance to the seminars given by your colleagues is mandatory and is part of the participation/attendance requirements for the course. Copy of the transparencies for the presentation must be received by the Instructor by **March 12 (11.59 PM)**. They can be given to him in person. Copies uploaded on WebCT are also acceptable, but it is your responsibility to make sure that the material has been received on time in a readable format (Power Point \*.PPT preferred).

### 6c Midterm and final assignments

Midterm and final assignments will involve the answer to questions related to the course program or, possibly, simple numerical calculations. These assignments may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

Assignments will be posted on the class WebCT site 48 hours in advance to the deadlines (Midterm: February 27, 11.59 PM - Final: April 9, 11.59 PM).

Deadline for the students to complete the midterm assignment (and post it on WebCT) is **February 29 (11.59 PM)**

Deadline for the students to complete the final assignment (and post it on WebCT) is **April 11 (11.59 PM)**

## 7. Participation

Attendance to classes and participation to the short lectures on specific types and/or applications of nanomaterials given by colleagues is mandatory. Participation will be checked randomly on five classes during the course and the participation mark will be proportional to the number of such classes attended.

### *Accommodations for Religious Holidays*

When scheduling unavoidably conflicts with religious holidays which a) require an absence from the University or b) prohibit or require certain activities (i.e., activities that would make it impossible for the student to satisfy the academic requirements scheduled on the day(s) involved), no student will be penalized for absence because of religious reasons, and alternative means will be sought for satisfying the academic requirements involved. If a suitable arrangement cannot be worked out between the student and instructor involved, they should consult the appropriate department chair and, if necessary, the student's Dean. It is the responsibility of such students to inform themselves concerning the work done in classes from which they are absent and to take appropriate action.

A student who, for either of the situations outlined in paragraph one above (a or b), is unable to write examinations and term tests on a Sabbath or Holy Day in a particular term shall give notice of this fact in writing to his or her Dean as early as possible, but not later than November 15 for mid-year examinations and March 1 for final examinations, i.e., approximately two weeks after the posting of the mid-year and final examination schedule respectively. In the case of mid-term tests, such notification is to be given in writing to the instructor within 48 hours of the announcement of the date of the mid-term test. If a Special Examination is offered as an alternative means to satisfy the academic requirements, the instructor(s) in the case of mid-term tests and the Dean in the case of mid-year and Spring final examinations will arrange for special examination(s) to be written at another time. In the case of mid-year and Spring final examinations, the accommodation must occur no later than one month after the end of the examination period involved. It is mandatory that students seeking accommodations under this policy give notification before the deadlines and that the Faculty accommodate these requests.

For purposes of this policy, the University has approved a list of dates which are recognized religious holidays which require members of those religions to be absent from the University; this list is updated annually and is available at Departmental, Deans' and Faculty advising offices.

## 8. Deadlines

The following table is indicative, and summarizes the most relevant deadlines during the course:

<b>February 24</b>	<b>Last day for scheduling the colloquium with the instructor for the selection of a specific type or application of nanomaterials to be studied individually more in detail and presented by the student in a short "lecture" during the final exam</b>
<b>February 27</b>	<b>Midterm assignment posted on the WebCT site</b>
<b>February 29</b>	<b>Midterm assignment to be completed by the students and uploaded on WebCT</b>
<b>March 12</b>	<b>Copy of the transparencies for the short lecture on a specific type or application of nanomaterials received by the Instructor</b>
<b>Mar 15 to Apr 5 (Thur. 2.30-3.30)</b>	<b>Short lectures on specific types and/or applications of nanomaterials given by the students to their colleagues (schedule arranged and communicated by the instructor)</b>
<b>April 9</b>	<b>Final assignment posted on the WebCT site</b>

<b>April 11</b>	<b>Final assignment to be completed by the students and uploaded on WebCT</b>
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### *Breaking deadlines*

Breaking the deadlines for scheduling the colloquium with the instructor, for completing and posting the assignments, and/or for providing the presentation slides to the instructor will result in -3% penalty for each additional day requested. Exceptional circumstances will be considered as in Sect. 7 and 9

### *Calculators*

The use of any electronic devices is not allowed during the final exam. The use of any electronic devices is allowed, and even encouraged, for the solution of the assignments and/or for the student to present their lecture on specific types or applications of nanomaterials.

## **9. Make-up Policy**

The following applies to all medical excuses involving work worth >10%.

If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to the Dean's office as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from the Dean's Office immediately. For further information please see:

<http://www.uwo.ca/univsec/handbook/appeals/medical.pdf>

A student requiring academic accommodation due to illness, should use the Student Medical Certificate when visiting an off-campus medical facility or request a Records Release Form (located in the Dean's Office) for visits to Student Health Services. The form can be found here:

[https://studentservices.uwo.ca/secure/medical\\_document.pdf](https://studentservices.uwo.ca/secure/medical_document.pdf)

### *Final Examination*

In accordance with Senate Policy, a Special Examination will be held within thirty days of the regular final examination for students who are unable to write the regular examination for medical or other documented reasons. Requests for such a Special Examination must be made to the Associate Dean, Faculty of Science.

Note that if you fail to write a scheduled Special Examination, permission to write another Special Examination will be granted only with the permission of the Dean in exceptional circumstances and with appropriate supporting documents. In such a case, the date of this Special Examination normally will be the scheduled date for the final exam the next time the course is offered.

In addition, you must clearly state the policy on medical excuses for all work worth <10%, as well as for non-medical excuses.

## **10. Class Web Site**

Please refer to <http://www.physics.uwo.ca/~gfanchin/> ("4850B Nanomaterials" and "course notes", left of the page)

## 11. Scholastic Offenses

### *Cheating*

Scholastic offenses are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offense, at the following Web site:

[http://www.uwo.ca/univsec/handbook/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf)

### *Plagiarism*

Students must write their assignments and prepare their presentations in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing (such as footnotes or citations). Plagiarism is a major academic offence (see Scholastic Offence Policy in the Western Academic Calendar).

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system.

## 12. Classroom Conduct

Disruptive behavior will not be tolerated in class. Please respect the rights of your classmates to benefit from the lecture by limiting your conversations to those essential to the class. Students who persist in loud, rude or disruptive behavior will be asked to leave.

## 13. Complaints and Suggestions

If you have a concern about something, please let us know. We rely on your feedback. Please contact initially your instructor. If that is not satisfactory, or if there is something more general bothering you, talk it over with the Physics & Astronomy Department Chair or the Associate Chair of Undergraduate Studies (for contact information see <http://www.physics.uwo.ca>).

## 14. Contacting Us

The simplest way to contact us outside of lectures is via your UWO e-mail account. Please allow 2–3 working days for a response.

*We will not **read or respond** to emails from addresses that do not end in “@uwo.ca” and these emails may be treated by the UWO webmail system as spam.*