

**Syllabus**  
**EE 5349-001**  
**Fundamentals of Bio-Nanotechnology**  
Fall 2009

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**GTA:** TBA  
**GTA Office Hours:** TBA

**Time and Place of Class Meetings:** Mondays and Wednesdays 1:00 - 2:20 PM, 108 Nedderman Hall

**Description of Course Content:** The goal of this course is to provide an insight into the fundamentals of nanotechnology in biological and biomedical research. The nanotechnology will have far reaching impacts is solving biological/medical problems. The emergence of solid-state devices at the nano-scale has spurred a new area for the sensing of biological species. The utilization of novel device designs and techniques have resulted in unprecedented sensitivity and selectivity. This course is designed to explore the applications of nanotechnology in sensing and detecting biological molecules, interactions and systems. The course caters for the interests and needs of students coming from different backgrounds. Basic biological molecules and the importance of their detection are discussed. Focus is also provided on solid-state materials, devices and systems as related to biological applications especially detection and sensing, covering top-down MEMS fabrication and bottom-up biochemistry. The state of the art in BioMEMS and bio-nanotechnology is covered with particular emphasis on

- (i) Introduction to micro/nano-fabrication
- (ii) Fundamentals of biological concepts (Genes, Proteins, Cells)
- (iii) Electronic properties of biomaterials
- (iv) MEMS/Nanoelectronics processing techniques and equipment
- (v) Specialized fabrication processes (DUV, e-beam lithography, etc)
- (vi) Nano-Bio interface issues in the functionalization of devices
- (vii) Molecular Recognition and Bio-specificity.

**Requirements:** Graduate or Senior Standing

**Required Textbooks and Other Course Materials:** "Bionanotechnology" is at the cross-roads of a number of important engineering and scientific fields. No textbook is classified as "Required", rather recommended textbooks are placed on reserve in the library. Lecture notes, class handouts, some e-books and reading list will be followed for the course. I will expect you to read assigned material before the associated lecture. A typical lecture will involve both review of methods, and a discussion of the underlying principles. We will also invite guest speakers that have expertise in bio-nano & related areas.

**Reference Text:** As no single text book can cover the wide-ranging and ever-evolving topics of this course, following books are listed as reference texts. These books are placed on "Reserve" for this course in the library.

1. Nanodevices for the Life Sciences  
Challa S. S. R. Kumar (Editor)  
ISBN: 978-3-527-31384-6  
John Wiley & Sons, Inc.
2. BioMEMS and Biomedical Nanotechnology  
Volume IV: Biomolecular Sensing, Processing and Analysis  
Set: BioMEMS and Biomedical Nanotechnology  
Editor-in-chief: Ferrari, Mauro  
2007, XXII, 407 pp., Hardcover, ISBN: 978-0-387-25566-8, Springer
3. Single-Molecule Techniques: A Laboratory Manual  
Editors: Paul R. Selvin, and Taekjip Ha  
2008, 507 pp., Hardcover, ISBN 978-087969775-4

**Descriptions of major assignments and examinations with due dates:** The course requires several homework assignments, one individual “Key Paper Review” presentation, a group research proposal and two exams. Wikipedia and/or other websites can not be used as a reference in any of the assignments of this course. Most of the assignments/projects are to be submitted through the WebCT course page. Put your First and Last name followed by assignment name in the file names.

**Grading Policy:**

Assignments	20%
Key Paper Review	20%
Group Research Proposal	25%
Midterm Exam	15%
Final Exam	20%

**Assignments:** Occasionally but no more than once per week, a problem related to the current course material will be assigned. The full credit will be given for a reasonable attempt at the problem (representing an hour or more of effort). Top 2 of each assignment solutions will receive 20% bonus points, and these solutions will be posted for inspiration to others (author name can be omitted, if requested). So if you want your solution to be considered, please prepare it electronically.

**Key Paper Review:** Each student is required to do a literature search on a specific topic in Bio-nano. The goal is to identify the key paper(s) that launched a particular topic of research. A key paper could be the first paper (go back to the 19th century if you have to), or it could be a paper that finally explained a perplexing phenomenon. Topics can be discussed with me and I can also give some ideas. You will propose the topic with a nomination report and I will approve it. The “nomination” of the paper will be **less than one page**. Identify the shortcomings and explain the state of the art. More details will be provided.

You will **choose the deadline** for the formal nomination report. The earlier you turn it in, more points can be gained. If you turn in the “KPR Nomination Report” before the end of September, you will receive a maximum of 20 points. If you turn it in by the middle of October, you will receive a maximum of 15 points. If you submit it by October 23, 2009, it will net you a maximum of 10 points. An earlier submission of report will maximize the utility of your report to your fellow students. On the other hand, flexibility in the due date can help you balance your workload. Include a bibliography of the research papers that you read in arriving at your Key Paper. Citations to peer-reviewed publications will be acceptable only. Your report will be disseminated to your classmates for their perusal and enjoyment. You will be asked to present the state of the art in the area directly stemming from the Key Paper.

**Group Research Proposal:** Towards the goals of developing a more interactive classroom environment and practicing analytical thinking and communication skills, a formal Group Research Proposal (report and presentation) will be developed in teams. The goal is to learn the process by which researchers, practicing engineers, and technology advisors, acquire, distill, process and present technically sound ideas based on alternative technological approaches to solve a problem. The aim is to turn data into information (meaningful data), and information into intelligence (actionable information). In the proposals we will not be competing for a multi-million dollar grant, rather we will apply this sort of approach to gauge our understanding and polish the critical thinking. The analysis would cover the state of the art and the synopsis of impeding problems/limitations. The major part of the proposal should present a technically sound solution backed with theory, data or simulation.

For this component of the course, the class will be divided into groups of 2 or 3 students. Attempt will be made to form teams with balanced and complementary training and experience. Each group will develop and submit the proposal report (**minimum 3 pages in length**) to me by **October 16, 2009**. Each individual is responsible to contribute equally. On the day of the presentation, the group will make 20-30 minute oral presentations. Following the presentations, everyone will be invited (and expected) to participate in discussion. Your performance, and the performance of your team, will make up a total of 25% of your course grade, broken down as follows:

- Report submitted by October 16, 2008: 10% of course grade. All members of the group will receive the same score.
- Individual participation during presentation/discussions: 10% of course grade. The instructor will assess this portion of your grade on the basis of the quality and quantity of your participation. Detailed grading rubric will be provided beforehand for guidance. Clarification questions will be

asked. You should be prepared to back up statements with references. Comments that clarify the issues or offer new ways to look at the problem will be considered particularly valuable.

- Peer Assessment: 5% of course grade. At the conclusion of the report, each of you will be asked to rate the individual presenter. A 1-5 scale will be used, with "3" representing "average" effort, "1" would be a "slacker," and "5" would be reserved for exceptional effort. You may be uncomfortable with peer assessment, but you will be asked to do this again and again no matter what career path you choose. These assessments will be collected anonymously and the average value of the class assessments of your effort will be used to determine your score on this component.

**Exams:** These will focus more on principles than methods. Dates of exams are:

Mid-term Exam:	Oct 5, 2009; In class
Final Exam:	Dec 7, 2009; 11 am-1:30 pm, Room TBD

**Attendance Policy:** The attendance record will not be maintained. The course content will evolve around class-discussions and lecture notes. It would be imperative to attend the class to grasp the concepts and follow the material. If you can not present the work assigned to you e.g. KPR or GRP, provide one week advance notice to the instructor.

**Make-up Exam/Assignment Policy:** If you can not meet an assignment deadline or appear for an exam or presentation, give me one-week advance notice. Email me, call a friend to email me or meet me before any anticipated conflict of schedule. No credit will be given for the missed assignment unless such absence/delay/failure-to-deliver occurs due to a documented emergency. You will be required to furnish written evidence to confirm the nature of emergency.

**Drop Policy:** The UT-Arlington drop policy will be followed as per the time table here:  
[http://www3.uta.edu/registrar/registration\\_schedule\\_Fall2009.asp](http://www3.uta.edu/registrar/registration_schedule_Fall2009.asp)

**Americans With Disabilities Act:** The University of Texas at Arlington is on record as being committed to both the spirit and letter of federal equal opportunity legislation; reference Public Law 92-112 - The Rehabilitation Act of 1973 as amended. With the passage of federal legislation entitled *Americans with Disabilities Act (ADA)*, pursuant to section 504 of the Rehabilitation Act, there is renewed focus on providing this population with the same opportunities enjoyed by all citizens.

The instructor is required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Student responsibility primarily rests with informing faculty of their need for accommodation and in providing authorized documentation through designated administrative channels. Information regarding specific diagnostic criteria and policies for obtaining academic accommodations can be found at [www.uta.edu/disability](http://www.uta.edu/disability). Also, you may visit the Office for Students with Disabilities in room 102 of University Hall or call them at (817) 272-3364.

**Academic Integrity:** It is the philosophy of The University of Texas at Arlington that academic dishonesty is a completely unacceptable mode of conduct and will not be tolerated in any form. All persons involved in academic dishonesty will be disciplined in accordance with University regulations and procedures. Discipline may include suspension or expulsion from the University. You are required to carefully read and sign the form titled "STATEMENT ON ETHICS, PROFESSIONALISM, AND CONDUCT FOR ENGINEERING STUDENTS." If you need soft copy of this statement, email the instructor/GTA.

"Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts." (Regents' Rules and Regulations, Series 50101, Section 2.2)

For the first occurrence of plagiarism by a student, a zero grade will be given on the exam, report, assignment, or project, as the case may be. Second occurrence of plagiarism by the same student (individual or in a team) will result in automatic reduction of one grade letter in the final grade of the course. The Office of Student Judicial Affairs will be informed in writing if two or more cases of plagiarism are found for any student.

Plagiarism has many shapes, but can be explained in a few examples under the scope of this course. It maybe presenting someone else's published words (and work) in a way that these words (and works) do not clearly show the source. Any text from someone else's work can not be used "verbatim" unless in double quotes and followed by a citation and appropriate credit. Website sources like Wikipedia are generally not allowed in this course but same policy of citation holds for internet sources also. If you are in doubt, ask the instructor/GTA.

**Student Support Services Available:** The University of Texas at Arlington supports a variety of student success programs to help you connect with the University and achieve academic success. These programs include learning assistance, developmental education, advising and mentoring, admission and transition, and federally funded programs. Students requiring assistance academically, personally, or socially should contact the Office of Student Success Programs at 817-272-6107 for more information and appropriate referrals.

**Library Resources:** Science and Engineering Library (SEL) has dedicated staff to help you find reserve books and guide you on finding the literature off library subscriptions that you might need. Staff is available to assist students individually or as a group. SEL maintains subject guides and works through library liaisons to acquire new materials. Remember "Not everything can be found with Google or Yahoo!".

**E-Culture Policy:** The University of Texas at Arlington has adopted the University email address as an official means of communication with students. Through the use of email, UT-Arlington is able to provide students with relevant and timely information, designed to facilitate student success. In particular, important information concerning registration, financial aid, payment of bills, and graduation may be sent to students through email.

All students are assigned an email account and information about activating and using it is available at [www.uta.edu/email](http://www.uta.edu/email). New students (first semester at UT-Arlington) are able to activate their email account 24 hours after registering for courses. There is no additional charge to students for using this account, and it remains active as long as a student is enrolled at UT-Arlington. Students are responsible for checking their email regularly.

The instructor/GTA will send important course-related information to your UT-Arlington e-mail address ONLY. Your email to the instructor/GTA should also come from a UT-Arlington email account. Your email message sent from non-UT-Arlington accounts may never reach the instructor/GTA. You will be responsible for any misplaced or misdirected email that is sent from non-UT-Arlington email address.

Submission of assignments, reports and presentations is strongly encouraged via WebCT (required in some cases). Upload the material before the deadline. Use standard software like Microsoft Office, Microsoft PowerPoint, Adobe Acrobat, etc. to prepare your answers. The final submission has to be in the form of PDF file. There are many free PDF-maker software available.

**Grade Grievance Policy:** If you have any grievance regarding a grade, consult with the instructor/GTA. Information about the UT-Arlington grievance policy is here:  
[http://www.uta.edu/gradcatalog/general\\_info#grievances](http://www.uta.edu/gradcatalog/general_info#grievances)

**Final Review Week:** A period of five class days prior to the first day of final examinations will be designated as FINAL REVIEW WEEK. The purpose of this week is to allow UT-Arlington students sufficient time to prepare for final exams. During this week, there will be no schedule or required activities such as field trips, seminars, or performances; and no themes, research problems or exercises of similar scope that have a completion date during or following this week will be assigned unless specified in the class syllabus. During Final Review Week, no exams constituting 10% or more of the final grade will be given, except make-up tests and laboratory examinations. In addition, no portion of the final exam will be given during Final Review Week.