

# Bioengr 188: Nanogenerators for Bioengineering

<b>Instructor</b>	<b>Prof. Jun Chen</b> Department of Bioengineering Room 4121H, Engineering V (420 Westwood Plz., Los Angeles, CA 90095) Tel: (310) 794-5550 Fax: (310) 794-5956 Email: <a href="mailto:jun.chen@ucla.edu">jun.chen@ucla.edu</a> Lab Website: <a href="https://www.junchenlab.com/">https://www.junchenlab.com/</a> Email: <a href="mailto:teacherjunchen@gmail.com">teacherjunchen@gmail.com</a> (For term papers and presentation slides)															
<b>Class Time</b>	<b>Monday &amp; Wednesday</b> 4:00 PM to 5:50 PM Winter Quarter 2022															
<b>Class Location</b>	<a href="https://ucla.zoom.us/my/teacherjunchen">https://ucla.zoom.us/my/teacherjunchen</a> (Online-Recorded) <b>BOELTER 5249</b> if UCLA allows in-person class.															
<b>Office Hour</b>	Right after the Wednesday class. Please stay online/in classroom for questions. Or contact Dr. Chen to schedule an appointment															
<b>Teaching Assistant</b>	<b>Alberto Libanori</b> Email: <a href="mailto:alibanori1@ucla.edu">alibanori1@ucla.edu</a> Thursday 4:00 PM to 5:00 PM Online in the Class <b>Zoom</b> or in <b>Boelter Hall 7732</b>															
<b>Prerequisites</b>	None															
<b>Textbooks</b>	Class lecture slides will cover all the required materials for the course and will be available on the class website. However, if you want to pursue a further reading, here are three suggested books <ol style="list-style-type: none"><li>1. <i>Triboelectric Nanogenerators</i>, Springer 2016, ISBN: 978-3319400389</li><li>2. <i>Piezoelectric Sensors and Actuators</i>, Springer 2019, ISBN 978-3662575321</li></ol>															
<b>Course Description</b>	The BE 188: Nanogenerators for Bioengineering addresses the fundamentals, materials, processes, manufacturing and devices fabrication for nanogenerators, showcasing key biomedical applications. Especially the nanogenerators in the biomedical fields is made including the circulatory system, the neural system, cell modulation, microbe disinfection, and biodegradable electronics. The functionality of nanogenerators can serve for energy, sensing and therapy purposes in bioengineering. The nanogenerators can be key components to realize an autonomous intelligent closed-loop sensing and therapeutic system on human body for personalized healthcare to conquer the medical fields in the era of Internet of Things.															
<b>Class Will Help You</b>	<ol style="list-style-type: none"><li>1. Learn basic knowledge of material synthesis and biomedical device design</li><li>2. Learn the cutting-edge research in the field of nanogenerators</li><li>3. Learn how to walk yourself quickly to the frontier of an interested topic</li><li>4. Learn how to effectively work as a team</li><li>5. Improve your scientific presentation/writing skills</li><li>6. Publish a review paper in a top-tier journal</li></ol>															
<b>Who Should Take</b>	All the undergraduates in engineering school or other related departments. This course is useful to the students who aim to pursue an academic career and who desire to work in the bioengineering industry.															
<b>Grading</b>	Midterm Exam 20% Class Participation 10% Seminar Presentation 35% Final Report 35% Final grades will be based on the following scale: <table><tr><td>100–95 A+</td><td>87–84 B+</td><td>76–74 C+</td><td>66–64 D+</td><td>&lt; 60 F</td></tr><tr><td>94–90 A</td><td>83–80 B</td><td>73–70 C</td><td>63–62 D</td><td></td></tr><tr><td>89–87 A-</td><td>79–77 B-</td><td>69–67 C-</td><td>61–60 D-</td><td></td></tr></table>	100–95 A+	87–84 B+	76–74 C+	66–64 D+	< 60 F	94–90 A	83–80 B	73–70 C	63–62 D		89–87 A-	79–77 B-	69–67 C-	61–60 D-	
100–95 A+	87–84 B+	76–74 C+	66–64 D+	< 60 F												
94–90 A	83–80 B	73–70 C	63–62 D													
89–87 A-	79–77 B-	69–67 C-	61–60 D-													

<b>Midterm Exam</b>	Midterm exam will be open-book and in-class. It will cover all the lecture materials from the beginning to <b>Feb. 09, 2022</b> . Unexcused absences will count as zero. If you miss a test without either a certified medical excuse or prior instructor approval, but with a reasonable explanation, you <b>may have one chance</b> to take a makeup test at a designated time during the final exam week. Tests missed with certified medical excuses or prior instructor approval will be dealt individually.
<b>Presentation</b>	<b>2 to 3 students</b> will work together to do a literature review in a specific topic they choose in the field of nanogenerators for bioengineering. Under Dr. Chen's guidance, each team will be walked to the frontier of the chosen topic. The team will be formed by <b>Jan. 19, 2022</b> . The team review topic should be determined by <b>Feb. 14, 2022</b> . The final presentation will be evaluated by both the instructor and the students in the class.
<b>Attendance</b>	Students are expected to attend all the classes. If you anticipate an excused absence on a due date, please contact Dr. Chen to make other arrangements. For more details, please read the UCLA attendance policy for definitions of excused absences.
<b>Academic Integrity</b>	Students are expected to adhere to the guidelines for academic integrity outlined in the UCLA Code of Student Conduct. Cases of misconduct will be addressed according to the procedures outlined in the Code. Your signature on any submitted work implies that you have neither given nor received unauthorized aid. For more information, please read <a href="https://www.deanofstudents.ucla.edu/studentconductcode">https://www.deanofstudents.ucla.edu/studentconductcode</a>
<b>Student Disabilities</b>	Reasonable accommodations will be made for students with verifiable disabilities. Students needing academic accommodations based on a disability should contact the Center for Accessible Education (CAE) at (310) 825-1501 or in person at Murphy Hall A255. In order to ensure accommodations, students need to contact the CAE within the first two weeks of the term.
<b>Non-Discrimination Policy</b>	UCLA provides equality of opportunity in education and employment for all students and employees. Accordingly, UCLA affirms its commitment to maintain a work environment for all employees and an academic environment for all students that is free from all forms of discrimination. Discrimination based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation is a violation of state and federal law and/or UCLA policy and will not be tolerated.  Harassment of any person (either in the form of quid pro quo or creation of a hostile environment) based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation also is a violation of state and federal law and/or UCLA policy and will not be tolerated. Retaliation against any person who complains about discrimination is also prohibited. UCLA's policies and regulations cover discrimination, harassment, and retaliation. Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should report at <a href="https://equity.ucla.edu/programs-resources/policy/">https://equity.ucla.edu/programs-resources/policy/</a> or call (310) 825-3935.
<b>Other Information</b>	It will be always appreciated if you can send suggestions for the improvement of any aspect of the course to Dr. Chen. By the way, as an associate editor of the top-tier journal <i>Biosensors and Bioelectronics</i> (impact factor: 10.618), Dr. Chen could use the journal as a support and guide through each team to develop the <b>Final Report</b> into a full review paper after the course. However, this is optional. As a professor, students are the most important part in my career as a professor. <b>I wish you all success in the class and always!</b> Please feel free to let me know whenever you need my support.

## Bioengr 188: Course Schedule

WEEK	DATE	TOPICS	DUES
<b>1</b>	01/03/2022	Introduction to Nanogenerators- An Overview	
	01/05/2022	Materials and Contact Electrification	
<b>2</b>	01/10/2022	Triboelectric Nanogenerators – Four Working Modes	
	01/12/2022	Convert Biomechanical Motions into Electricity	
<b>3</b>	01/17/2022	Martin Luther King, Jr. Holiday ( <b>No Class</b> )	
	01/19/2022	Triboelectric Nanogenerators for Biomonitoring	<b>Form a Team</b>
<b>4</b>	01/24/2022	Triboelectric Nanogenerators for Therapeutic Applications	
	01/26/2022	Piezoelectric Materials and Piezoelectric Effect	
<b>5</b>	01/31/2022	PENGs for Biomechanical Energy Harvesting	
	02/02/2022	Piezoelectric Nanogenerators for Biosensing	
<b>6</b>	02/07/2022	Piezoelectric Nanogenerators for Therapy	
	02/09/2022	<b>Mid-Term Exam (In Class Open Book)</b>	
<b>7</b>	02/14/2022	Magnetoelastic Generator for Energy and Healthcare	<b>Team Topics</b>
	02/16/2022	Skills for Scientific Presentation and Writing	
<b>8</b>	02/21/2022	Presidents' Day Holiday ( <b>No Class</b> )	
	02/23/2022	Textile Nanogenerators for Energy Harvesting	
<b>9</b>	02/28/2022	Textile Nanogenerators for Biomonitoring & Therapy	
	03/02/2022	Team Seminar Presentation	
<b>10</b>	03/07/2022	Team Seminar Presentation	
	03/09/2022	Team Seminar Presentation	
<b>11</b>	Final Week	Optional meeting with each team for 30 mins to give constructive suggestions	
<b>Quarter Ends</b>	03/18/2022	<b>Final Report Due</b>	