



University of Puerto Rico
Mayagüez Campus
College of Engineering
Department of Mechanical Engineering
M.S./Ph.D. in Mechanical Engineering



Course Syllabus

1. General Information:
Alpha-numeric codification: INME 6170 Course Title: Biomedical Micro-Electro-Mechanical Systems (BIOMEMS) Number of credits: 3 Contact Period: Three hours of lecture per week
2. Course Description:
English: Discussion of advanced topics in Biomedical Micro-Electro-Mechanical Systems (BioMEMS). Analysis of the underlying physical, chemical and biological phenomena in BioMEMS as applied to medical and biological sciences. Design of BioMEMS based on the current trends in the field of biomedical science and engineering.
Spanish: Discusión de temas avanzados de sistemas microelectromecánicos biomédicos (BioMEMS). Análisis de los fenómenos físicos, químicos y biológicos pertinentes a sistemas BioMEMS y sus aplicaciones a las ciencias médicas y biológicas. Diseño de BioMEMS a base de las tendencias actuales en el campo de la ciencia e ingeniería biomédica.
3. Pre/Co-requisites and other requirements:
Pre-requisite: Authorization of the Director of the Department
4. Course Objectives:
Upon the completion of this course, the student will be able to” <ol style="list-style-type: none">1. Explain what a BioMEMS is and why miniaturization matters;2. Describe the physical phenomena behind the inner workings of BioMEMS;3. Recall and explain various micromanufacturing methods;4. Explain the basics of BioMEMS design;5. Articulate the integration of biological sciences, chemistry and engineering that make up a BioMEMS;6. Apply the knowledge gained in class to design a BioMEMS device for given application.7. Study and discuss real world BioMEMS applications;8. Recall and describe state of the art BioMEMS techniques and applications.
5. Instructional Strategies:
<input checked="" type="checkbox"/> conference <input checked="" type="checkbox"/> discussion <input type="checkbox"/> computation <input type="checkbox"/> laboratory
<input type="checkbox"/> seminar with formal presentation <input type="checkbox"/> seminar without formal presentation <input type="checkbox"/> workshop
<input type="checkbox"/> art workshop <input type="checkbox"/> practice <input type="checkbox"/> trip <input type="checkbox"/> thesis <input checked="" type="checkbox"/> special problems <input type="checkbox"/> tutoring
<input checked="" type="checkbox"/> research <input type="checkbox"/> other, please specify:

6. Minimum or Required Resources Available:

Classroom with data display. Computing facilities. Access to online peer-reviewed scientific journals. Computer with internet, spreadsheet software, mathematical and finite element analysis software.

7. Course time frame and thematic outline

General Topics	Contact Hours
BioMEMS, An Introduction	
HW # 1 Finding BioMEMS opportunities on campus	
Microfabrication	
Microfluidics	
COMSOL Multiphysics	
HW # 2 COMSOL tutorials	
MATLAB	
Project proposal and discussion	
Surface Patterning	
Molecular Biology On-Chip	
BioMEMS for Biotechnology	
BioMEMS for Cell Biology	
Biosensors	
Tissue Microengineering	
Implantable Microdevices	
Case studies	
Midterm Exam	
Total hours: (equivalent to contact period)	45

8. Grading System

Quantifiable (S/NS) Not Quantifiable

9. Evaluation Strategies

	Quantity	Percent
<input checked="" type="checkbox"/> Exams	0-2	0-40
<input type="checkbox"/> Final Exam		
<input checked="" type="checkbox"/> Quizzes	0-3	0-20
<input type="checkbox"/> Oral Reports		
<input type="checkbox"/> Monographies		
<input type="checkbox"/> Portfolio		
<input checked="" type="checkbox"/> Final Project equivalent to final exam	1	0-20
<input type="checkbox"/> Journals		
<input checked="" type="checkbox"/> Other, specify: Homework (including project updates) Assistance	0-5	0-20 0-20
TOTAL:		100%

10. Bibliography:**Textbook:**

1. Folch, Albert. 2013. *Introduction to BioMEMS*, Boca Raton: CRC Press. [Available at the Circulation Collection (TP248.25. N35 F65 2013) UPRM General Library]

Additional References

2. Badilescu S., Packirisamy M. 2011. *BioMEMS: Science and Engineering Perspectives*, Boca Raton: CRC Press.
3. Saliterman S. 2005. *Fundamentals of BioMEMS and Medical Microdevices*, Washington: SPIE Press. [Available at the Circulation Collection (TP248.25. N35 S25 2006) UPRM General Library]**
4. Ghodssi R., Lin P. (eds). 2011. *MEMS Materials and Processes Handbook*, Springer US. [Available at the Electronic Collection (TK7875 .M46 2010) UPRM General Library]
5. Ferrari M., Ozkan M., Heller M.J. (eds). 2007. *BioMEMS and Biomedical Nanotechnology, Volume II: Micro/Nano Technologies for Genomics and Proteomics*, Springer US. [Available at the Electronic Collection (TP248.25. N35 M53 2006) UPRM General Library]**
6. Ferrari M., Bashir R., Wereley S. (eds). 2007. *BioMEMS and Biomedical Nanotechnology, Volume IV: Biomolecular Sensing, Processing and Analysis*, Springer US. [Available at the Electronic Collection (TP248.25. B54 B56 2006) UPRM General Library]**
7. Urban, G.A. (ed). 2006. *BioMEMS*, Springer US. [Available at the Electronic Collection (TK7875. B528 2006) UPRM General Library]**
8. Electronic resources available through the Library's website:
<http://www.uprm.edu/library/cre/listdbsp.php?l=1&st=0&topic=77>

** These books are key classic references and remain as the top books for the subjects covered in the course and there are no up-to-date textbooks to substitute these books.

11. Law 51: The Comprehensive Educational Services Act for People with Disabilities:

States that after identifying with the instructor and the institution, the student with disabilities will receive reasonable accommodation in their courses and evaluations. For more information, contact the Department of Counseling and Psychological services at the Office of the Dean of Students (Office DE 21) or call 787-265-3864 or 787-832-4040 x 3772, 2040 and 3864.

12. Academic Integrity

The University of Puerto Rico promotes the highest standards of academic and scientific integrity. Article 6.2 of the UPR Students General Bylaws (Board of Trustees Certification 13, 2009-2010) states that academic dishonesty includes, but is not limited to: fraudulent actions; obtaining grades or academic degrees by false or fraudulent simulations; copying the whole or part of the academic work of another person; plagiarizing totally or partially the work of another person; copying all or part of another person answers to the questions of an oral or written exam by taking or getting someone else to take the exam on his/her behalf; as well as enabling and facilitating another person to perform the aforementioned behavior. Any of these behaviors will be subject to disciplinary action in accordance with the disciplinary procedure laid down in the UPR Students General Bylaws. —

13. Certification 06-43 of the Academic Senate

"The academic guidelines for offering online courses," defines: Traditional face-to-face courses are those that have less than 25% of the course's regular contact hours via the Internet. Therefore, a three-credit course will be considered "face to face" if, of the 45 hours of regular contact, 11 or less are taught via the Internet. According to certification 06-43 of the Academic Senate, a course may include up to 25% of its total contact hours via the Internet. The objective of this is so that all professors have this alternative in the case of any unscheduled eventuality.

14. Sexual Harassment: Certification 130-2014-2015 states:

Sexual harassment in the workplace and in the study environment is an illegal and discriminatory act and is against the best interests of the University of Puerto Rico. All persons who understand they have been subject to acts of sexual harassment at the University of Puerto Rico may file a complaint and request that the institution investigate, where necessary, and assume the corresponding action by the university authorities. If the complainant is a student, he or she must refer his or her complaint to the Office of the Student Ombudsperson or that of the Dean of Students.

Revised: February, 2019