Instructors: Robi Polikar, Maria Tahamont (Guest lectures on anatomy and physiology)
Office & Phone: Polikar - 136 Rowan, 256-5372 Tahamont – 256 Science Hall, 256-3584
Office Hours: Dr. Polikar – T:11:00-12:00, F 13:00–14:00, Dr. Tahamont T/Th 9:30-10:45
E-mail: polikar@rowan.edu tahamont@rowan.edu

Class Meeting: Wednesdays 16:45 – 19:15, at Rowan 239 – unless changed on mutual consent.

A basic medical dictionary, available at any bookseller. See the reference list if you would like to purchase a comprehensive medical dictionary for future reference.

References: Medical Instrumentation, Application and Design, Webster, 3rd/e, Wiley, 1998,

ABOUT THIS CLASS & OBJECTIVES

As a survey of biomedical engineering, this class will introduce various systems of the human physiology, signals of biological origin obtained from these systems, biosensors, transducers and bioelectrodes used to acquire such signals, along with medical quality amplifiers for measuring biopotentials. Electrical safety of medical devices; measurements of the blood pressure, blood flow, and respiratory system will also be discussed. Time permitting, we will also cover contemporary issues such as clinical laboratory equipment, medical imaging and bioethics.

The main objective of this course is to introduce you to basic biomedical engineering technology, so that you can understand, design and evaluate systems and devices that can measure, test and/or acquire biological information from the human body. In order to achieve this goal, we will emphasize

- Essential background on anatomy and physiology, in particular fundamental characteristics of signals acquired from the human body;
- Electrical safety issues that must strictly be adhered to in designing medical equipment;
- Practical issues in designing and testing electronic medical equipment;
- Specific algorithms and techniques in analysis and processing of biological signals;
- Ethical issues regarding biomedical and biotechnology research.

Upon successful completion of this class, you will be able to analyze, evaluate and compare existing medical equipment technologies for a variety of physiological systems. You will also be able to make sound judgments in designing such equipment with respect to characteristics of the physiological system for which the equipment is designed.
Class Mechanics

This class will meet once a week, for 150 minutes each. Because this is an introductory level survey oriented course, we will cover a significant amount of material, without going into much detail. This class is intended to motivate and inspire you to pursue further education and/or career opportunities in biomedical engineering (BME). If it achieves this intention, you will be able to acquire the required detailed information in your future BME work.

No class in BME can be divorced from the anatomy and physiology (A&P) of the relevant systems. Therefore, we will be covering such topics as we go along. Dr. Maria Tahamont, Professor of Biology here at Rowan, has graciously agreed to give guest lectures on A&P. These A&P modules will be distributed throughout the semester. You will also be responsible from this A&P content. Due to amount of material that will be covered in this course, the meetings will be typically in the classroom, mostly featuring lecture format. However, we have recently acquired six medical grade biopotential amplifiers along with various transducers that will allow us to have meaningful laboratory experience.

Homework, Quizzes, Exams & Current Biotech Events

In this class, you will have a substantial amount of reading assignments from the text as well as from other sources, which will be provided for you. Graduate students will have additional reading assignments and corresponding evaluation mechanisms, in the forms of quizzes or presentations. There will also be problem type assignments, as well as hands-on design assignments. Problem and design assignments will be done in teams. There may be unannounced quizzes from primarily reading assignments. The group assignments will first receive an assignment grade, which will then be adjusted for individual contribution at the end of the semester. There will also be a midterm and a final exam. Late submissions will lose 20% for each week they are late. Finally, I expect you to read / follow media on current biotechnology events and news. Quizzes and exams may include a question asking what recent biotechnology related news you have heard. Your answer should include a brief summary of the news / development, the reference (where you have read it / heard it), and the time the event was announced. Your answer should not be more then 1 month old, to encourage you to actively look for biotech related news.

Final Project

A final project to help you put all course-developed skills to work will be assigned. You will be working in teams of two or three for this project. You may pick one of two avenues for the project: 1.) You will design / test / evaluate / implement a device / procedure / algorithm of relevant interest; or 2.) you will design a new lab experiment, in a class related area of your choice. The project report will be a complete description and the protocol of the experiment you design, along with its background engineering and physiology information. These experiments will then be used in future core or elective ECE courses, such as networks, DSP, ECOMMS, EMAGS, electronics, etc. The project will have different expectations depending whether you are a graduate or undergraduate student.

Undergraduate Students:

1.) The work may replicate a former work as published in a technical journal; or 2.) You will design an experiment for one of the core undergraduate ECE courses

Graduate Students:

1.) Your design must be novel in at least some aspect of the work. 2.) You will design an experiment for one of the graduate elective ECE courses, including this course.

Rules of the Conduct:

- Absolutely no eating /drinking in class (water, only, is allowed).
- Cell phones must be kept outside of class or shut-off during class. No exceptions! If your cell-phone rings during class (or you use it in any way), you will be asked to leave and counted as unexcused absent. It will also cause difficult-to-repair damage to “professionalism” part of your grade (see below).
• No web surfing and/or unrelated use of computers, when we use computers in class/labs.
• In-class discussions are always welcome, and in fact encouraged, within the limits of mutual respect and courtesy.
• You are responsible for checking the class web page often for announcements.
• You are encouraged to work with other students for all out-of-class exercises.
• Although I do not anticipate, and certainly hope that it will never be an issue, it is my responsibility to remind you that academic dishonesty—in any form, shape or manner—will not be tolerated, and will be dealt with according to university rules and regulations. In loose terms, presenting any work, or a portion thereof, that does not belong to you, as if it does—or even attempting to do so—is considered academic dishonesty.

**Attendance Policy & Estimated Amount of Work**

Attendance is required for your successful completion of this course. While, I do not take regular attendances, I do check who is in class on random occasions, particularly when a few people are absent. Note that I do consider class participation as part of professional etiquette, which appears as 10% of your final grade. Your eagerness to learn new material should be your major source of motivation for coming to class. However, the following may also help improve your inspiration and motivation:

Considering that this is completely a new field for most, if not all of you, successful completion of this course will demand significant amount of time commitment, a good portion of which may be spent on reading. Expect to learn a number of new medical terms, for which I recommend at least a basic medical dictionary. As a rule of thumb, expect to spend three-four hours for each hour we spend in class. Please budget your time accordingly, as this is just an average. You will most likely need less time during the first couple of weeks of the class, but most certainly more time towards the end of the semester. While the content of the course is not necessarily difficult, the estimated amount of time commitment is 10 hours a week due to amount of reading and experimentation you will be doing.

**Prerequisites**

**Absolutely Necessary Prerequisites:**
- Enthusiasm and genuine interest, patience, time commitment, perseverance

**Would Be Really Helpful Prerequisites:**
- Basic physics and calculus. Intermediate level signals and system, electronics and digital systems.

**Programming Prerequisites:**
- Basic knowledge of MATLAB or C/C++

**Grading Scale**

Since this is an upper level class, your grade will depend more on the in-class and out-of-class lab exercises, homework assignments, and the final project, rather than exams. An absolute grading scheme will be used to assess your final grade, which will consist of the following components:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Exams</td>
<td>30%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>10%</td>
</tr>
<tr>
<td>HW/Lab</td>
<td>25%</td>
</tr>
<tr>
<td>Project</td>
<td>30%</td>
</tr>
<tr>
<td>Professionalism</td>
<td>5%</td>
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<table>
<thead>
<tr>
<th>Grade</th>
<th>Score</th>
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<tbody>
<tr>
<td>100-95: A</td>
<td>95-90: A-</td>
</tr>
<tr>
<td>89-87: B+</td>
<td>86-83: B</td>
</tr>
<tr>
<td>79-77: C+</td>
<td>76-73: C</td>
</tr>
<tr>
<td>69-67: D+</td>
<td>66-63: D</td>
</tr>
<tr>
<td>59-0: F</td>
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Note that doing everything you are asked to do in this class will get you a “C”. An “A” is reserved only for those who exhibit outstanding performance, delivering above and beyond the minimum asked to complete the course. All work must be completed to pass the course. For credit, work is due at the beginning of the class period assigned and must be presented in a professional manner.
TEAM WORK POLICY

You are not only allowed, but in fact required to work in teams for all class related work, including all homework assignments and the semester project, unless specifically asked to do otherwise for certain exercises and exams. All team members need to contribute equally to all team exercises. I will employ various mechanisms to determine the individual contributions to group project(s). Therefore, not everyone in a given group will necessarily receive the same grade!

TENTATIVE SCHEDULE

<table>
<thead>
<tr>
<th>Week of</th>
<th>Material to be uncovered</th>
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</thead>
<tbody>
<tr>
<td>August 30</td>
<td>Introduction and motivation: Why do we study biomedical engineering, basic measurement and physiological concepts.</td>
</tr>
<tr>
<td>September 6</td>
<td>The origin of biopotentials, electrical activity of excitable cells, action potentials, membrane models</td>
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<tr>
<td>13</td>
<td>The origin of biopotentials, continued: ECG, EMG, EEG, MEG, etc.</td>
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<tr>
<td>20</td>
<td>Biopotential electrodes and amplifiers</td>
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<tr>
<td>27</td>
<td>Measurement of blood flow and pressure</td>
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<tr>
<td>October 4</td>
<td>Cardiovascular system, hemodynamics - Midterm exam</td>
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<tr>
<td>11</td>
<td>Respiratory system, measurements of the respiratory system</td>
</tr>
<tr>
<td>18</td>
<td>Measurement of blood pressure</td>
</tr>
<tr>
<td>25</td>
<td>Processing of biological signals - Part I</td>
</tr>
<tr>
<td>November 1</td>
<td>Processing of biological signals - Part II</td>
</tr>
<tr>
<td>8</td>
<td>Contemporary topics - Clinical laboratory systems</td>
</tr>
<tr>
<td>15</td>
<td>Contemporary topics - Biomedical imaging systems</td>
</tr>
<tr>
<td>22</td>
<td>Electrical safety</td>
</tr>
<tr>
<td>29</td>
<td>Contemporary topics - Other</td>
</tr>
<tr>
<td>December 6</td>
<td>Contemporary topics - Other</td>
</tr>
<tr>
<td>13</td>
<td>FINALS WEEK</td>
</tr>
</tbody>
</table>

This, of course, is a tentative schedule. We are unlikely to cover this many topics in such a short period of time, particularly if spend time on experiments. We will look for creative ways to make the most of our time. The last two weeks indicating – Other contemporary topics, will most likely be overwritten by the topics we try to finish covering.

INSTRUCTOR EVALUATION, QUESTIONS, COMMENTS, SUGGESTIONS

Questions, constructive criticisms, comments, and suggestions are always welcome. Please feel free to share your opinions about all aspects of the class: content, level, workload, instructor’s communication skills (or lack thereof), etc. There will be a box outside of my office for anonymous comments. You may use Dr. Polikar’s “I’ve Got Something To Say!”® forms, available on class web page.
I am having difficulty in understanding the following concepts:

This week’s class was informative / interesting / entertaining / ________ (circle all that apply) because:

This week’s class was confusing / boring / too fast / too slow / ________ (circle all that apply) because:

It would have been much better / beneficial if you could…:

Please continue the following activities as I find them useful in ________

While you are at it, please provide your feedback on the following on a scale of 1 – 5,
1: Poor / Strong disagreement with the phrase, 5: Excellent / strongly agree with the phrase

1. The professor’s ability to communicate in a clear and understandable manner: _____
2. The professor’s responsiveness to student’s needs, questions and ideas: _____
3. The professor treat students in a professional manner: ______
4. The professor is enthusiastic about the subject and genuinely believes in its importance: _____
5. The professor's knowledge of the subject material is thorough: ______
6. The professor is well prepared for the classes: ______
7. The professor’s ability to impart knowledge about the subject is: ______
8. The professor encourages questions and comments during the class session: ______
9. The professor’s use of the class time is: ______
10. The professor actively involves students in the teaching / learning process: ______
11. The professor’s availability outside of class hours is: ______
12. The professor satisfactorily answers students’ questions in class and in the office: ______
13. Professor clarifies /repeats material that is difficult to understand: ______
14. Professor makes use of the latest technology to improve student’s learning experience: ______
15. Lecture materials (e.g. slide) are helpful for the understanding of the subject material: ______
16. The professor is genuinely concerned that students take valuable experience from the class: ______
17. Considering everything, how would you rate this teacher: ______

What do you not like about Dr. Polikar’s teaching, if any, and what would you suggest that he can do improve?

What do you enjoy about Dr. Polikar’s teaching, if any, that he should continue in this and future classes?

“I’ve got something to say!” Course & Instructor Evaluation – Robi Polikar © Fall 2004.