1. Catalog Description (3 credits): This course deals with statistical analysis of biomedical signals from a multivariate time series analysis perspective. Starting from the theory of stochastic processes we introduce analysis concepts and methods both in the time domain and in the spectral domain. Whenever possible actual recordings from biomedical applications will be used to demonstrate the methods.

2. Pre-requisites and Co-requisites: Multivariate calculus and basic knowledge of probability and statistics.

3. Course Objectives: This course will acquaint the student with all the major methods for analyzing multivariate biomedical signals from a time series analysis perspective. Physiological examples, especially those from neuroscience, will be used to illustrate the concepts and methods.

4. Contribution of course to meeting the professional component (ABET only): N/A

5. Relationship of course to program outcomes (ABET only): N/A

6. Instructor: Prof. Mingzhou Ding
   a. Office location: BMS J285
   b. Telephone: 273 9332
   c. E-mail address: mding@bme.ufl.edu
   d. Web site: www.bme.ufl.edu
   e. Office hours: TBA

7. Teaching Assistant: TBA
   a. Office location:
   b. Telephone:
   c. E-mail address:
   d. Office hours: by appointment

8. Meeting Times: M W F Period 9 (4:05 pm to 4:55 pm)

9. Class/laboratory schedule: none

10. Meeting Location: NEB 350

11. Material and Supply Fees: none

12. Textbooks and Software Required: No textbooks. Course notes and handouts will be distributed.


14. Course Outline:

   1. Gaussian Random Variables (7-8 lectures)
      i. Concept of random variables
      ii. Review of univariate Gaussian distributions
      iii. Multivariate Gaussian distributions
      iv. Assessing the relations among random variables: correlation, multiple correlation and partial correlation.

   2. Multivariate Time Series: Time Domain Approach (6-7 lectures)
      i. Concept of stochastic processes
      ii. Stationarity and ergodicity
      iii. Time series models
a. AR Models
b. ARMA Models
iv. Estimating time series models from data
v. Assessing the relations among time series
vi. Information theoretic measures: Mutual information and complexity

   i. Spectral representation of stationary time series
   ii. Assessing the relations among time series in the spectral domain: coherence, multiple coherence and partial coherence
   iii. Estimating spectra: data based estimation versus model based estimation
   iv. Examples

4. Evaluating Causal Relations in Biomedical Systems (6-7 lectures)
   i. Wiener-Granger causality
   ii. Geweke’s spectral decomposition
   iii. Statistical assessment of significance
   iv. Examples from neurophysiology

15. Attendance and Expectations: Attendance is strongly encouraged. Students are expected to take careful class notes
16. Grading: 70% Homework, 30% Final Project
17. Grading Scale: Curved grading will be applied
18. Make-up Exam Policy: N/A
19. Honesty Policy – All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.
20. Accommodation for Students with Disabilities – Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.
21. UF Counseling Services – Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
   - University Counseling Center, 301 Peabody Hall, 392-1575, Personal and Career Counseling.
   - SHCC mental Health, Student Health Care Center, 392-1171, Personal and Counseling.
   - Center for Sexual Assault/Abuse Recovery and Education (CARE), Student Health Care Center, 392-1161, sexual assault counseling.
   - Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.
22. Software Use – All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do
so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

*Note: Statements in items 19-22, should be included as is.*