

**Florida Atlantic University
Center for Complex Systems
Neurobiological Signal Processing
ISC 6466 (84634 & 84741)
Fall 2008**

Credit Hours: 3

Days: W

Hours: 12:30 – 3:20PM

Instructor: Dr. Bressler

Web Site: <http://www.ccs.fau.edu/~bressler/EDU/NSP/NSP.html>

Phone: 7-2322

Office Hours: By appointment

Grading: Attendance (20%), Midterm (40%), Final (40%)

COURSE OUTLINE

1. Neural Generators
2. The Model Neuron
 - a. Sign of Action
 - b. Model Neuron Components
 - c. Patterns of Synaptic Connection
3. Electrical Generation
 - a. Current Fields
 - b. Topological Model
 - c. Axon Fields
4. Genesis of the EEG
 - a. Unitary Generators
 - b. Current Flow During Synaptic Activation
 - c. Current Source Density
 - d. Populations of Unitary Neuronal Waves
 - e. Generation of the EEG
5. Temporal Characteristics of the EEG
 - a. Temporal Synchronization
 - b. The EEG as a Signal
6. Data Acquisition
 - a. Analog-to-Digital Conversion
 - b. Quantization Noise
 - c. Multiplexing
7. Time Series and Random Processes
 - a. Time Functions
 - b. Stochastic Processes
 - c. Statistical Properties
8. Signal Estimation
 - a. Signal and Noise
 - b. Superimposition
 - c. Averaging
 - d. Estimation of Variability
 - e. Confidence Intervals
9. Covariance Analysis
 - a. Autocovariance
 - b. Crosscovariance
10. Spectral Analysis
 - a. The Fourier Transform
 - b. Fourier Series Representation
11. Power Spectra
 - a. Magnitude and Phase
 - b. Power
 - c. Power Spectrum and Autocovariance
12. Bandwidth Limited Time Series
 - a. Nyquist Frequency
 - b. Bandwidth Limited DFT
 - c. Aliasing
 - d. Periodization
13. Leakage
14. Power Spectral Estimation
15. Cross Spectral Analysis
 - a. Cross Spectrum
 - b. Coherence
 - c. Phase
16. Digital Filtering
 - a. Impulse Response
 - b. Transfer Function
 - c. Time Smearing
 - d. Frequency Smearing and Side Lobes
 - e. Smoothing by Digital Filtering
 - f. Recursive Filters