

# **ECE 697EO-1- Advanced Engineering and Optimization of Systems**

Department of Electrical and Computer Engineering  
University of Massachusetts at Amherst  
**Spring 2012**

**Instructor : Prof. Alfred P. DeFonzo ( 121 Marcus,  
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**Location and Time : MWF 2:30-3:20 Elab 327**

**Office Hours: TBA**

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## **Course Goals**

The students will learn about engineering and optimization of modern complex information gathering and utilizing systems from the modeling of the subsystems and estimators to the abstraction of these systems in terms of information oriented metrics and the integration and optimization of such systems. They will learn how advanced multi-objective optimization methods are used to generate design vectors in design space and their image in objective space for purposes of supporting the decision making that drives the optimization and evolution of such engineered systems. The material will be presented in the context of a contemporary real world engineered system, which will be developed as a case throughout the course with results from emulations and simulations in comparison to test beds.

## **Topics**

**Engineering and Evolution of Complex Systems –What’s H.O.T. and What’s N.O.T.**

Uniquetarity/ Unitarity

Missing Information

Maximum Entropy

Ontological and Epistemological Commitments

Over Fitting Under Fitting

Sampling Complexity-Jeffreys Priors, Von Neuman Bets, Fisher Information, Shannon Information, Loss Functions, Accuracy, MDL, MaxEnt,MaxLike, Kolmogorov structure function. Objective Bayesian

Mathematical deduction/ scientific inference

**Optimization Lessons from Signal Processing**

Separation of Concerns

Hierarchies

Abstract State Machines

Agents

Modeling

Single Autonomous agent system

Narrow AI : Problem Solving, Planning , Learning

**Optimization Lessons from Machine Learning**

Information and Uncertainty: Intelligibility and Context Dependence

Collaborative Agent Systems

### **Optimization Lessons from Organizational Learning**

Multi Objective Optimization

Cyber-Physical Information Gathering and Utilizing Systems

Search

## **Course Materials**

This is the first offering of an experimental course is based on direct reference materials from the literature and internet.

**Grading: Participation 50%; Assignments %50**

**Useful Reference Texts: TBA**

**Foregoing Subject to revision at Instructors Discretion**