George Mason University
School of Information Technology and Engineering
Department of Electrical and Computer Engineering

ECE 620 | **Optimal Control Theory** | **SPRING 2005**
Professor Beale | **Science & Technology II – 257** | **703-993-1596**
http://ece.gmu.edu/~gbeale/ece_620/syl_620.html | gbeale@gmu.edu

OFFICE HOURS: Tuesday: 1:30 – 2:45 p.m.
Wednesday: 5:30 – 7:00 p.m.
Thursday: 1:30 – 2:45 p.m.
Other hours by appointment only.

PREREQUISITES: ECE 521 or POI.

COURSE TEXT: *Optimal Control*, 2nd Edition, F.L. Lewis and V.L. Syrmos, John Wiley & Sons, 1995, Chapters 1–5, 7.

HONOR AND EXAM POLICY:

All students are expected to abide by the George Mason University Honor Code. Each of the two projects for the course will be done individually. The midterm exam and the final exam will be open book and open notes. All work must be your own on the projects and the exams. Any reasonable suspicion of an honor violation will be reported.

OBJECTIVES:

1. To provide students with the purposes, terminology, and fundamental mathematics of optimal control theory.
2. To enable students to intelligently evaluate optimal control techniques and to design control systems that behave in an optimal fashion.
3. To enable students to understand the literature and conduct research in the field of optimal control.

GRADING:

Midterm Exam	25%
Design Project	25%
Paper Review	15%
Final Exam	35%

EXAM SCHEDULE:

Midterm Exam	Wednesday, March 2	Chapters 1, 2
Final Exam	Wednesday, May 11 7:30 – 10:15 p.m.	Chapters 3, 4, 5, 7

Last Day to Drop without Dean's Permission: Friday, February 25
No class on Wednesday, March 16 due to **SPRING BREAK!!!**

COURSE OUTLINE

Chapter 1	Introduction: what optimal control is, comparison with classical control, useful performance measures, an optimal control example, static optimization – 1.5 weeks.
Chapter 2	General discrete-time optimal control problem for dynamic systems, discrete linear quadratic regulator, the steady-state regulator and its properties, frequency domain results – 3.5 weeks.
Chapter 3	Dynamic continuous time systems, the general optimal control problem, Pontryagin's minimum principle, the linear quadratic regulator problem, the steady-state regulator – 3 weeks.
Chapter 4	Continuous-time and discrete-time optimal tracking control – 2 weeks.
Chapter 5	The Minimum Principle for constrained input problems, minimum time control, minimum fuel control – 2 weeks.
Chapter 7	Polynomial formulation for discrete-time systems, polynomial performance indices, optimal polynomial control – 1 week.

References

[1] B. D. Anderson and J. B. Moore, *Optimal Control: Linear Quadratic Methods*. Englewood Cliffs, NJ: Prentice Hall, 1990.

[2] M. Athans and P. L. Falb, *Optimal Control*. New York: McGraw-Hill, 1966.

[3] A. E. Bryson and Y. C. Ho, *Applied Optimal Control*. New York: John Wiley & Sons, revised ed., 1975.

[4] P. Dorato, C. Abdallah, and V. Cerone, *Linear Quadratic Control*. Englewood Cliffs, NJ: Prentice Hall, 1995.

[5] M. J. Grimble and M. A. Johnson, *Optimal Control and Stochastic Estimation*, vol. 1. New York: John Wiley & Sons, 1988.

[6] D. E. Kirk, *Optimal Control Theory*. Englewood Cliffs, NJ: Prentice Hall, 1970.

[7] E. Lee and L. Markus, *Foundations of Optimal Control Theory*. Krieger, reprint ed., 1986.

[8] E. Mosca, *Optimal, Predictive, and Adaptive Control,*. Englewood Cliffs, NJ: Prentice Hall, 1995.

[9] G. M. Siouris, *Optimal Control and Estimation Theory*. New York: John Wiley & Sons, 1996.

[10] R. F. Stengel, *Stochastic Optimal Control*. New York: John Wiley & Sons, 1986.

[11] K. Zhou, J. C. Doyle, and K. Glover, *Robust and Optimal Control*. Upper Saddle River, NJ: Prentice Hall, 1996.