

**COMMONWEALTH GRADUATE ENGINEERING PROGRAM  
DISTANCE LEARNING COURSE PLANNING SHEET  
UNIVERSITY OF VIRGINIA**

Course ECE 728 - Digital Control Systems Semester Spring 2005  
Instructor Gang Tao Phone No. 434-924-4586  
Office Address University of Virginia; Department of Electrical and Computer Engineering;  
Thornton Hall E311; P.O. Box 400743; Charlottesville, VA 22903  
E-Mail Address gt9s@virginia.edu

Textbook(s): (Student to purchase)

Benjamin C. Kuo, *Digital Control Systems*, Oxford University Press, 2nd Ed., 1992, ISBN 0-19-512064-7

Lecture Notes on Digital Control Systems, Gang Tao, University of Virginia Bookstore, 434-924-1066  
(ask for Lecture Notes for ECE 728)

Reference(s): (To be put on library reserve) - Limit 4

Gene F. Franklin, *Digital Control of Dynamic Systems*, Addison-Wesley, 3rd ed., Reading, MA, 1998.

C. L. Phillips and H. T. Nagle, Jr., *Digital Control System Analysis and Design*, Prentice-Hall, 3rd ed., 1995.

G. C. Goodwin and K. S. Sin, *Adaptive Filtering Prediction and Control*, Prentice-Hall, 1984.

Computer Needs:

Computer Capability Numerical computing  
Software required? Matlab Provided? No  
Other \_\_\_\_\_

**Attached are course syllabus and biographical sketch.**

**ECE 728 – Digital Control Systems** (*Spring 2005*, 3 credits)

Objective:

Study the modern theory and design techniques of discrete-time control systems.

Description:

This course covers concepts and theorems of sample/hold processes, z-transforms with applications, transfer functions and state space models of digital control systems, controllability and observability, stability theory, system analysis and control design techniques in frequency domain and time domain, parameter estimation and adaptive control theory for discrete-time systems.

Prerequisites:

ECE 402 or ECE 621, or equivalent.

Instructor:

Gang Tao, Thornton Hall, room E311, 434-924-4586, gt9s@virginia.edu.

Lecture time:

3:30 - 4:45 pm, Mondays and Wednesdays.

Textbook:

Benjamin C. Kuo, *Digital Control Systems*, Oxford University Press, 2nd Ed., 1992.

*Lecture Notes on Digital Control Systems*, Gang Tao, University of Virginia Bookstore, 2005.

Topics:

1. Introduction to digital control systems (1 lectures)
2. Signal conversion and the sampling theorem (2 lectures)
3. The z-transform with applications (3 lectures)
4. Transfer functions and block diagrams (2 lectures)
5. State variable techniques (2 lectures)
6. Controllability, observability and stability (4 lectures)
7. Stabilization and state feedback control (2 lectures)
8. State observer and output feedback control (2 lectures)
9. Optimal control (3 lectures)
10. Model reference control (2 lectures)
11. Parameter estimation (2 lectures)
12. Discrete-time adaptive control (2 lectures).

References:

1. Gene F. Franklin, *Digital Control of Dynamic Systems*, Addison-Wesley, 3rd Ed., 1998.
2. C. L. Phillips and H. T. Nagle, Jr., *Digital Control System Analysis and Design*, Prentice-Hall, 3rd ed., 1995.
3. G. C. Goodwin and K. S. Sin, *Adaptive Filtering Prediction and Control*, Prentice-Hall, 1984.

Grading:

1. Homeworks: 20 %;
2. Midterm: 30 %;
3. Project: 10%;
4. Final Exam: 40 %.

Department of Electrical and Computer Engineering, University of Virginia

**ECE 728 – Digital Control Systems** (*Spring 2005, 3 credits*)

(Instructor: **Gang Tao**)

Gang Tao received his B.S. degree in Electrical Engineering from University of Science and Technology of China in 1982, his M.S. degrees in Electrical Engineering, Computer Engineering and Applied Mathematics in 1984, 1987 and 1989, respectively, and Ph.D. degree in Electrical Engineering in 1989, all from University of Southern California. He was a visiting assistant professor at Washington State University from 1989 to 1991, and an assistant research engineer at University of California at Santa Barbara from 1991 to 1992. He joined Department of Electrical Engineering at University of Virginia in 1992, where he is now an associate professor.

He is an associate editor for *Automatica*, and was a guest editor for *International Journal of Adaptive Control and Signal Processing* and an associate editor for *IEEE Transactions on Automatic Control*. He has been a program committee member for numerous international conferences. He was the organizer and chair of 2001 International Symposium on Adaptive and Intelligent Systems and Control, held in Charlottesville, Virginia, USA. He has co-edited one book, authored or co-authored four books, 55 journal papers and 6 book chapters, and over 135 conference papers/presentations on adaptive control, nonlinear control, multivariable control, optimal control, control applications and robotics.

He has taught many engineering and mathematics courses, including linear control systems, modern control theory, signals and systems, electrical science, digital control systems, adaptive control, optimal control, linear models, introduction to control systems, electric circuit analysis, random processes in engineering, robotics, electronics lab, controls lab.

His recent research includes adaptive control of systems with actuator and sensor nonlinearities, adaptive control of systems with actuator failures, adaptive control of multivariable systems, control of sandwich nonlinear systems with nonsmooth nonlinearities, control of real-time systems, control of magnetic bearing systems for artificial heart pumps, control of physiological systems, and robotics. His research has been supported by ARMY, DARPA, NASA, NIH, and NSF, and by Edison Power, MedQuest, and SCEEE.