System Dynamics/Control (Dr. Wejinya, chair)
<u>Recommended Text:</u>
<u>Modern Control Systems</u>, 12th Edition, By Richard C. Dorf and Robert H. Bishop.
<u>Supplemental Text:</u>
Feedback Control of Dynamic Systems, 6th Edition by Gene F. Franklin , J. David Powell and Abbas Emami-Naeini.

<u>Topics:</u>
Basic courses: mathematics; linear algebra; analysis of circuit; signal and systems. This text is designed for an introductory undergraduate course in control systems. The aim of this text is to make students have the basic concepts and rudimentary knowledge about linear time-invariable continuous systems and will give students a broader understanding of control system design and analysis.

Contents and time arrangement
Chapter one: Introduction to control systems (2 hours)
§1-1 History of automatic control
§1-2 Construction of automatic control systems
§1-3 Principle of feedback control
§1-4 Examples of control systems
Chapter two: Mathematical models of systems (8 hours)
§2-1 Introduction
§2-2 Differential equations of physical systems
§2-3 Linear approximation of physical systems
§2-4 The transfer function of linear systems
§2-5 Block diagram models
§2-6 Signal-flow graph models
§2-7 State variable models
Chapter three: The performance of control systems in time domain (10 hours)
§3.1The transient response
  3.1.1 Performance of a first-order system
  3.1.2 Performance of a second-order system
  3.1.3 Performance of a high-order system
§3.2 The stability of Linear system
  3.2.1The concept of stability
  3.2.2 Routh-Hurwitz stability criterion
§3.3 The continuous response
  3.3.1 Steady-state error
  3.3.2 Constant of steady-state error
  3.3.3 Steady-state error caused by disturbance
§3.4 The time response of the state variables of a control system
  3.4.1 Solution of the unforced system
  3.4.2 Solution of the state differential equation
  3.4.3 Solution of the state differential equation by taking the Laplace transform

3.4.4 The evaluation of the state transition matrix
3.4.5 The state transition matrix characteristics

Chapter four: The root locus method (4 hours)

§4.1 The root locus concept

§4.2 The root locus procedure

§4.3 Control system analysis utilizing the root locus method

Chapter five: Frequency response method (10 hours)

§5.1 Frequency response concept

5.1.1 Nyquist diagram
5.1.2 Bode diagram
5.1.3 Minimum phase and non-minimum phase system

§5.2 The Nyquist criterion

§5.3 Relative stability

§5.4 Closed-loop frequency response and the transient response

§5.5 Approaches to system design with the frequency response

5.5.1 System design concept
5.5.2 Phase-lead design using the bode diagram
5.5.3 Phase-lag design using the bode diagram

Chapter six: State variable method (6 hours)

§6.1 Controllability

6.1.1Controllability concept
6.1.2 Controllability criterion

§6.2 Observability

6.2.1 Observability concept
6.2.2 Observability criterion

§6.3 Jordan criterion

§6.4The duality theory

§6.5 The design of state variable feedback systems

6.5.1 State feedback
6.5.2 Pole placement using state feedback
6.5.3 The observer concept
6.5.4 Observer design
6.5.5 Separation property