Columbia University
Electrical & Mechanical Engineering Departments

EEME E6601 – Introduction to Control Theory
Fall Semester 2023 – Mudd 833

Professor: Nicolas W. Chbat, PhD
Teaching Assistants: V. Gonzalez, D. Nasilowski
Course Assistants: Y. Li, Z. Wu, S. Yarlagadda

High-Level Syllabus		
Section	**Topic**	**Weeks**
I	*Analysis* of Continuous-time Feedback Systems	3
II	Continuous-Time Controller *Design* in the Frequency Domain	3
III	Discrete-Time Feedback Systems (*Digital* Control)	7
Detailed Syllabus		
Week	**Topic**	**Hours**
1	Modeling, ODE, Transfer Function, Command & Disturbance Responses, Simulink	3
2	Steady-State Error, Root Locus Analysis	3
3	Z-transform, Sampling, Zero-order Hold, A/D & D/A converters	3
4	Routh & Jury Stability Criteria, Bode Diagram	3
5	Frequency-domain Controller Design, Relative & Absolute Stability	3
6	Digital Controller Representation, Difference Eqn Solution	3
7	Closed-loop System Performance, Nyquist Plot	3
8	Sampled-data Control Systems, "Longman Equivalence"	3
9	State-Space Formulation, Pole Placement	3
10	State Observer Design	3
11	Continuous to Discrete Conversion, Controllability, Observability	3
12	Digital Controller & Observer Design, Implementation	3
13	LQR (linear quadratic regulator), MPC (model predictive control)	3
14	Review	3
Extra	Lab session: Controls experiment	2

Grade:

Homework:	33%
Exam 1:	22%
Exam 2:	<u>45%</u>
Total:	**100%**

Textbooks (on reserve in Library**):**

1. **Ogata,** *Modern Control Engineering* (on reserve)
2. **Frederick, Chow** *Feedback Control Problems Using Matlab* (on reserve)
3. **Chow, Frederick, Chbat** *Discrete-Time Control problems using Matlab* (on reserve)

Rationale: Designing a control system and implementing it on a digital system is a control engineer's task. Necessary methodologies like modeling and system identification accompany controller design. A good grasp of classical and modern control analysis & synthesis are fulcrum to modern engineering systems.