NEW YORK UNIVERSITY TANDON SCHOOL OF ENGINEERING
Department of Mechanical and Aerospace Engineering

Mechatronics (ROB-GY 5103)

Fall 2023 — **Section A** — 3.0 credits

William Z. Peng, Ph.D
Tuesdays 2:00 PM – 4:30 PM
6 MetroTech Center
Jacobs Building, Room 474

Office Hours
Weekly Schedule TBD
6 MetroTech Center
Rogers Hall, Room 501A

Contact
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Course Webpage
NYU Brightspace

Main Text Vikram Kapila, *Mechatronics class notes*, Polytechnic Institute of NYU, Brooklyn, NY, 2009.

Prerequisites Graduate standing. Advisor's approval. Consent of instructor.

Course Objectives

- Understand key building blocks of mechatronics systems.
- Understand the principle of operation of mechanical, electrical, electronic, and opto-electronic components.
- Understand physical laws governing the operations of sensors and actuators including signal conditioning and power electronics.
- Gain proficiency in microcontrollers—fundamentals, operation, programming, and interfacing.
- Acquire ability to work with control analysis and design software (e.g., MATLAB and Simulink) for feedback control, data analysis, system monitoring, virtual instrumentation, rapid control prototyping, hardware-in-the-loop simulation, etc.
- Design, construct, and evaluate a prototype mechatronics system involving e.g., industrial automation, machinery monitoring/fault detection, embedded control, robotics, etc.

Topics Introduction to theoretical and applied mechatronics, design and operation of mechatronics systems; mechanical, electrical, electronic, and opto-electronic components; sensors and actuators including signal conditioning and power electronics; microcontrollers—fundamentals, programming, and interfacing; and feedback control. Includes structured and term projects in the design and development of prototype integrated mechatronic systems.

Materials Mechatronics is a practical, hands-on class that requires a microcontroller, sensors, actuators, electronic components, etc. Students will be responsible for procuring materials. The materials list will be available on NYU Brightspace.

Format Each lesson consists of lectures and practical exercises during class. There are no formal graded homework assignments.

Grading Policy **Midterm** 30 pts + **Final Exam** 25 pts + **Term Project** 45 pts ± **Extra Credits**† 10 pts = **Final Grade**

Final to Letter Grade

Letter	A	A–	B+	B	B–	C+	C	F
Final Grade	≥95	≥90	≥87	≥83	≥80	≥75	≥70	<70

† **Extra credits** of up to +10 pts will be awarded for active and professional class participation (e.g., discussion and interactions during lecture), and **up to –10 pts will be deducted for negative participation** (e.g., disrupting instruction through excessive chatter). Note that there is no deduction of points for absences.

Course Schedule

Week	Date	Content
1	Sep 5	Introduction to microprocessors, computerized data acquisition, and microcontrollers
2	Sep 12	Review of electrical and electronic components
3	Sep 19	Basic Stamp 2 microcontroller operation: overview, features, and operation
4	Sep 26	Basic Stamp 2 microcontroller: programming and input/output component interfacing
5	Oct 3	Review of opto-electronic components
6	Oct 10	**Legislative Monday (No Class)**
7	Oct 17	**Guest Lecture**
8	Oct 24	Introduction to analog/digital sensors
9	Oct 31	**Midterm***
10	Nov 7	Interfacing hardware (RC-time, 555 timer, operational amplifiers, ADC, DAC, etc.)
11	Nov 14	Analog/digital actuators: principles, power electronics, microcontroller interfacing
12	Nov 21	
13	Nov 28	Integrated mechatronics design, feedback control
14	Dec 5	
15	Dec 12	**Final Exam* & Early Project Presentations**
16	Dec 19	**Term Project Due* & Project Presentations**

**Exam dates and project deadlines are final.*

Exam Policy The final exam and written portion of the midterm exam are closed-book, closed-notes, and administered individually. The practical portion of the midterm exam is administered to self-selected groups of three.

Academic Integrity Refer to **NYU Tandon Policies and Procedures on Academic Misconduct** for Student Code of Conduct (also uploaded to NYU Brightspace).

Other Resources

NYU's Moses Center for Students with Disabilities
726 Broadway, 2nd floor | *www.nyu.edu/csd* | 212-998-4980 | mosescsd@nyu.edu
Students with disabilities must register with CSD to receive accommodations.

NYU's Wellness Exchange
Available via 24-hour hotline 212-443-9999, chat through the Wellness Exchange app, or appointment for mental health resources. Confidential and free of charge.

Inclusion Statement NYU values an inclusive and equitable environment for all our students. The instructor of this course hopes to foster a sense of community in this class and consider it a place where individuals of all backgrounds, beliefs, ethnicities, national origins, gender identities, sexual orientations, religious and political affiliations, and abilities will be treated with respect. It is this instructor's intent that all students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength, and benefit.

Additional Readings

- D. G. Alciatore and M. B. Histand, *Introduction to Mechatronics and Measurement Systems*,
- McGraw-Hill, 2003.
- N. C. Barga, *Robotics, Mechatronics, and Artificial Intelligence: Experimental Circuit Blocks for*
- *Designers*, Newnes, 2002.
- C. W. de Silva, *Mechatronics: An Integrated Approach*. CRC Press, Boca Raton, FL, 2004.
- P. Horowitz and W. Hill, *The Art of Electronics*, Cambridge University Press, 1989.
- R. Isermann, *Mechatronic Systems Fundamentals*, Springer. London, U.K., 2003.
- D. Necsulescu, *Mechatronics*, Prentice-Hall, 2002.
- G. Onwubolu, *Mechatronics: Principles and Applications*, Elsevier, Burlington, MA, 2005.
- P. Scherz, Practical Electronics for Inventors, McGraw-Hill/ TAB Electronics, 2006.
- D. Shetty and R. A. Kolk, *Mechatronics System Design*, PWS, 1997.
- D. Wilcher, *LEGO Mindstorms Mechatronics*. McGraw-Hill, New York, NY, 2004.