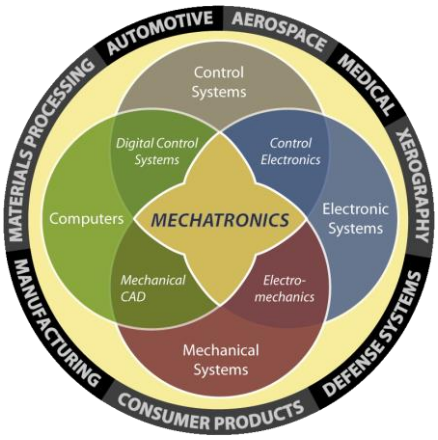
Mechatronics MEC 450 / 550

Course Description:
Mechatronics is multidisciplinary, model-based, systems engineering. It is the synergistic combination of mechanical engineering, electronics, control engineering, and computer systems, all integrated through the design process from the start of the design process. This course covers electromechanical and fluid power mechatronic system design: modeling and analysis of dynamic physical systems, control sensors and actuators, power and control electronics, feedback, feedforward, and observer controller design, and computer control implementation. There is extensive use of MatLab / Simulink and relevant MatLab Toolboxes. The NI myRIO and myDAQ, together with LabVIEW real-time programming, are used with actual mechatronic hardware systems.



Prerequisites: Prerequisite knowledge required is a basic introductory knowledge of modeling and analysis of dynamic physical systems, electronics and instrumentation, feedback control of dynamic systems, and the use of MatLab / Simulink.

Instructor:
Dr. Kevin Craig, Professor of Mechanical Engineering; Office: Adams Hall 113A;
Cell Phone: 518-858-3771; Office Phone: 518-463-6020; E-Mail: kevin.c.craig@hofstra.edu.

Course Content: All instructor-developed course material is available electronically.

Assignments:
- Problems will be assigned, and collaboration is encouraged. The problems will be made as real-world and relevant as possible. They will not be collected or graded. Solutions will be posted. These will be a source for exam questions.
- Two individual-work graded exercises will be assigned, each worth 15% of the final grade. You will have approximately 3 weeks to complete each graded assignment.

Examinations:
There will be two written, closed-note, closed-book, 90-minute, in-class exams during the semester, each worth 20% of the final grade. A cumulative, closed-book, closed-note written final exam is worth 30% of the final grade.

Class Attendance, Preparation, and Participation:
Attendance at all classes is mandatory and participation in class is strongly encouraged. Each session will be conducted with an interactive, applied, mentoring approach. Questions will be answered, and difficult concepts explained. Students are expected to participate interactively.

Grade Summary:

Exams (2 @ 20% each)	40%
Graded Assignments (2 @ 15% each)	30%
Final Exam	30%

Student Accessibility Support Center Statement

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Student Accessibility Support Center, ECC (Educational Communications Center) Building, Room 128, (631)632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Student Accessibility Support Center. For procedures and information go to the following website: http://www.stonybrook.edu/ehs/fire/disabilities.

Academic Integrity Statement

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website athttp://www.stonybrook.edu/commcms/academic_integrity/index.html

Critical Incident Management

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.

Week #	Topic
1	1- Mechatronic System Design Process; Model-Based Design; Digitization: Physical & Mathematical Modeling of Mechanical & Electrical Systems
2	2 - Time and Frequency Domain Dynamic System Response: Analytical & Simulation
3-5	3 – Electromechanics & Maxwell's Equations; Solenoids; Mechatronic Motors: Brushed DC, Step & Brushless DC
6-8	4 - Open-Loop & Closed-Loop Control Systems: Feedback, Feedforward, and Observer Control Design; Root-Locus, Frequency-Response, & State-Space Control Design
9	5 - Power Electronics for Mechatronics: Op-Amps, Diodes, Transistors, Power Switches, Rectification, Inversion
10	6 - Measurement Systems for Mechatronics; Motion Sensors: Optical Encoders, Accelerometers, Gyroscopes; Sensor Fusion
11	7 - Electromechanical System Components: Gearheads, Leadscrews, Belt & Pulley, Rack & Pinion, Clutches & Brakes, Servo Couplings, Feedback Devices
12	8 - Introduction to Hydraulics & Fluid Power Systems; Fluid Properties & Fluid Dynamics Fundamentals; Transmission Lines
13	9 - Electrohydraulic System Components: Control Valves (Directional, Pressure & Flow), Hydraulic Actuators (Linear & Rotary), Hydraulic Pumps (Fixed & Variable Displacement); Hydrostatic Transmissions
14	10 - Electrohydraulic Motion Control Systems: Valve-Controlled & Pump-Controlled