ME 460: Electromechanical Systems Design
ME 560: Precision Machine Design and Instrumentation

Prof. Andre Sharon

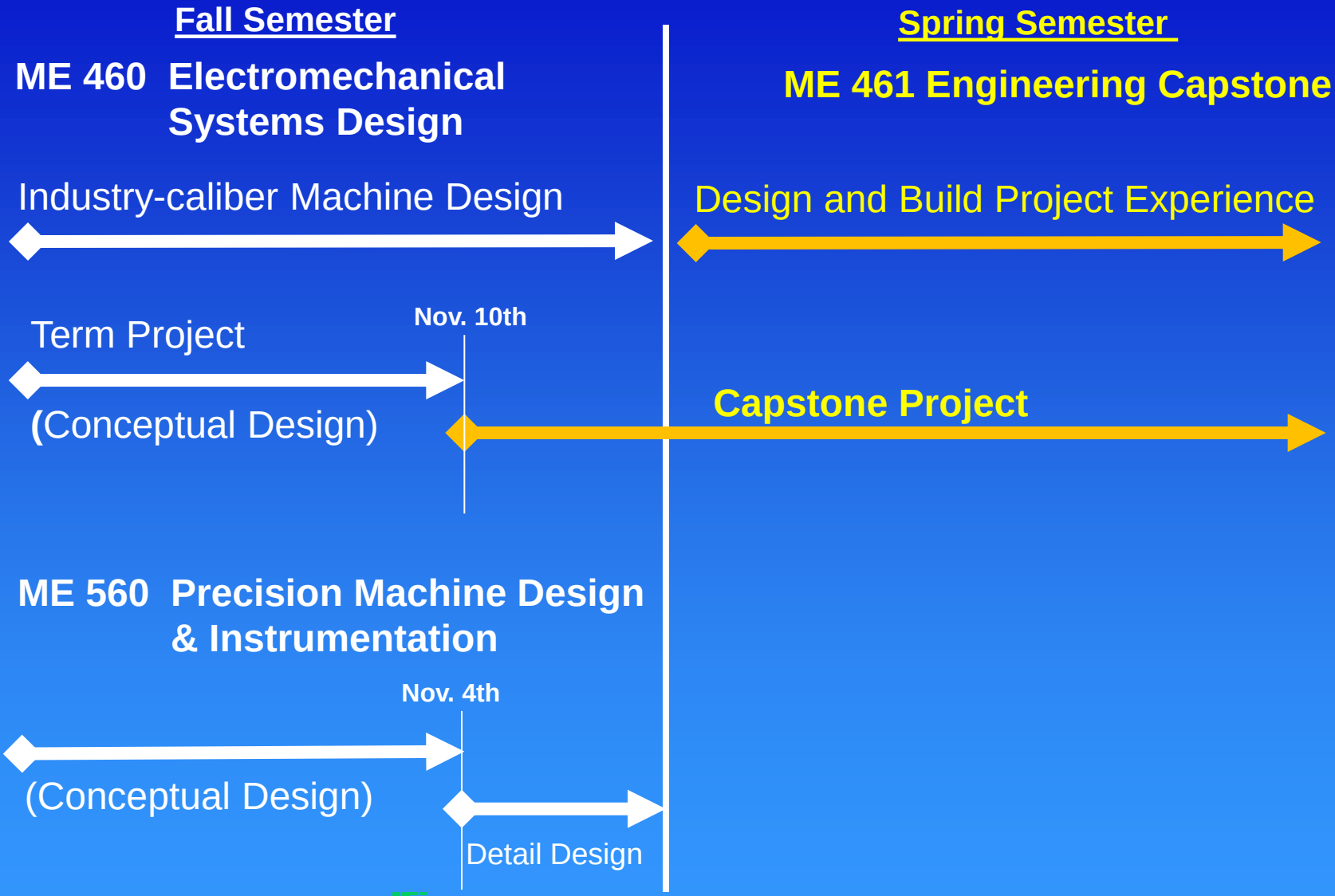
3-8776

sharon@bu.edu

Fraunhofer USA Center for Manufacturing Innovation

BOSTON UNIVERSITY

Senior Design Curriculum



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ME 460/560 Course Goals:

- Equip students with the knowledge and experience to design instrumented, computer controlled machinery.
- Teach students how to financially justify and successfully execute a machine development project.
- Give students interdisciplinary hands-on experience in the design of electromechanical systems through a term project.

Course Topics:

1. Machine Design and Instrumentation Strategy
    - Examples of Precision Automation Equipment (slides & videos)
    - Design: Science or Art?
    - Design Strategies
    - Project Phases
    - Functional Requirements and Design Parameters
2. Financial Justification and Project Planning
    - Presentation and Justification to Management
    - ProForma Analysis
    - Return on Investment
    - Project Scheduling
3. Actuators
    - Rotary Motors
    - Linear Motors
    - AC/DC
    - Stepper Motors
    - Hydraulic/Pneumatic Actuators
    - Solenoids and Voice Coils
    - Piezoelectric Actuators
4. Transmission Elements
    - Gears
    - Lead/Ball Screws
    - Rack & Pinion
    - Belts/Chains
    - Mechanical Linkages
    - Backlash, Stiction, Friction
5. Joints and Bearings
    - Rotary Pin Joints
    - Rotary Bearings
    - Bushings
    - Linear Bearings
6. Sensors
    - Incremental and Absolute Encoders
    - Tachometers
    - Accelerometers
    - Strain Guages
    - Force Sensors
    - Flow Sensors
    - Temperature Sensors

Course Topics:

7. Servo Control and Design for Controllability
    - System Modeling
    - Closed Loop Control
    - PID
    - System Response
    - Actuator/Sensor Location
8. Computer Control Hardware
    - Motion Controllers
    - Input/Output Devices
9. Vision and Image Processing
    - Cameras and Lenses
    - Image Processing Strategies

ME 460 Class Grading

Prof. Andre Sharon
3-8776
sharon@bu.edu
Office Hours: Fri 3-5pm

Project:	**50%**
Quizzes (3):	**30%**
Homework:	**20%**

Rebecca Livant
3-1888
rlivant@fraunhofer.org

ME 560 Class Grading

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Office Hours: Fri 3 -5pm

Term Project:	**70%**
Quizzes (3):	**20%**
Homework:	**10%**

Rebecca Livant
3-1888
rlivant@fraunhofer.org

Important Dates:

Sept 29th:	**Quiz # 1**
Nov 10th:	**460 Term Projects Due. 560 PDRs Due.**
Nov 17th:	**Quiz # 2**
Dec 3rd:	**560 FDRs Due**
Dec 10th:	**Quiz # 3**

Course Texts:

Textbook:

Machine Design and Control - A Systems Level Approach

Andre Sharon, Wiley Custom Printing

References:

- Handbook of Modern Sensors: Physics, Designs, and Applications;

Jacob Fraden, Springer-Verlag

- Machinery's Handbook, Industrial Press
- The Mechatronics Handbook, Robert Bishop, Ed., CRC Press

HW #1:

Selected Readings from Textbook:

Chapter 1 – Section 1.2, 1.4

Chapter 2 – Section 2.1