

Asian Institute of Technology
School of Engineering and Technology

AT74.03 Sensing and Actuation 3(2-3)

Semester: August

Course Objective: The objective of this course is to provide an understanding of the principle and design of sensors and actuators which are the building blocks for Mechatronics systems.

Learning Outcomes: Upon completion of this course, the students should be able to:

- Comprehend sensing principles of sensors available in the market.
- Apply actuation principles of actuators available in the market.
- Select available sensors/actuators or design new sensors/actuators for real applications.

Prerequisite: None

Course Outline:

I. Sensing Principle

1. Introduction to Sensing
2. Static and Dynamic Characteristics of Sensors
3. Motion and Dimensional Sensors
4. Force, Torque, and Power Sensors
5. Pressure and Sound Sensors
6. Fluid Flow Sensors
7. Temperature Sensors

II. Electrical Actuators

1. Introduction to Electro-Magnetic Principle
2. Classification of Electrical Actuators
3. DC Motors and Modeling
4. DC Motor Drivers
5. AC Motors and Modeling
6. AC Motor Drivers
7. Stepper Motors and Modeling
8. Stepper Motor Drivers

III. Hydraulic and Pneumatic Actuators

1. Description of Fluid Behavior
2. Hydraulic Actuator and System
3. Pneumatic Actuator and System

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ADRC Approval: _____

Academic Senate Approval: _____

Laboratory Session(s):

- Positional Resistance Transducers
- Wheatstone Bridge Measurements
- Temperature Sensor
- Light Measurements
- Linear Position and Force Applications
- Environmental Measurements
- Rotational Speed or Position Measurement
- Sound Measurements
- Operational Amplifier and Basic Operational Amplifier
- Inverting Amplifier – DC Operation
- Inverting Amplifier – Alternating Input
- Integrator; Non-Inverting Amplifier
- Summing Amplifier
- Difference Amplifier
- Comparator Circuits
- Logarithmic Scales and Simple RC Filters
- LC Band Pass Filter
- Low Pass π Filter
- Twin T Notch Filter
- Active Filters – 1
- Active Filters – 2
- Composite Filters
- Switched Capacitor Filters.

Textbook: Lecture Notes will be provided.

Reference Books:

1. K. Brindley, Sensors and Transducers, Heinemann Newnes, 1989.
2. J. W. Dally, W. F. Riley, and K.G. McConnell: Instrumentation for Engineering Measurements, 2nd edition, John Wiley & Sons Inc., 1993.
3. E. O. Doebelin: Measurement Systems Application and Design, 5th edition, McGraw-Hill, 2003.
4. P. Hauptmann: Sensors, Principles & Application, Prentice Hall, 1993.
5. J.L. Jones and A.M. Flynn: Mobile Robots, Inspiration to Implementation, AK Peters, 1999.
6. R.D. Klafter, T.A. Chmielewski, and M. Negin: Robotic Engineering, An Integrated Approach, Prentice-Hall International Edition, 1989.
7. Y. Koren: Robotics for Engineers, McGraw-Hill International Edition, 1987.
8. W. Stadler: Analytical Robotics and Mechatronics, McGraw-Hill International Edition, 1995.

Journals and Magazines:

School Recommendation: _____

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Academic Senate Approval: _____

1. IEEE/ ASME Transactions on Mechatronics, IEEE
2. IEEE Transactions on Robotics and Automation, IEEE
3. Mechatronics, Elsevier
4. International Journal of the Japan Society for Precision Engineering, JSPE
5. Journal of Instrumentation and Control Engineers, i-manager publications

Teaching and Learning Methods: Methods used are lectures, laboratory work and class exercises.

Time Distribution and Study Load:

Lectures: 30 hours

Laboratory sessions: 45 hours

Self study: 90 hours

Evaluation Scheme: Mid semester examination(40%), final examination (40%) (both are opened book), laboratory sessions and exercises (20%).

In the evaluation, an "A" will be awarded if a student demonstrates an excellent level of understanding of the principles and demonstrates excellent capabilities in sensing and actuation related applications.

"B" will be awarded if a student demonstrates an average level of understanding of the principles and demonstrates average capabilities in sensing and actuation related applications.

"C" will be given if a student demonstrates below average level of understanding of the principles and demonstrates below average level of capabilities in sensing and actuation related applications.

Instructor(s): Dr. Manukid Parnichkun

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ADRC Approval: _____

Academic Senate Approval: _____