Transducers and Instrumentation: Theory & Lab

**Semester**: Jan – April 2022

**Course Instructor:** Sivakumar Balasubramanian (Bioengineering, CMC Vellore)

**TA**: Monisha Yuvaraj, Charles Jebaraj, Sriramachandran (Bioengineering, CMC Vellore)

**Duration:** 14-16 weeks, 3hrs of lecture/tutorials per week, 3hrs lab per week

# Detailed Course Content

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| Module Name |
| **Introduction to measurement**  Measurement; Measuring instrument; Transducer & sensors; Generalized static characteristics of sensors; Generalized dynamic characteristics; Error analysis; Sampling |
| **Basic Instrumentation**  Operational amplifier; Linear circuits with op-amps; First order and second order filters. System identification. |
| **Measuring movements: linear and rotational**  Resistive; Inductive; Capacitive; Digital sensors; Camera based tracking; Accelerometer; Gyroscope. |
| **Measuring effort: Force and Torque**  Strain gauges. |
| **Measuring pressure, flow, volume.**  Piezoelectric sensors, differential/absolute pressure, flow, and volume sensing methods. |
| **Measuring temperature.**  Thermocouple; Thermistor; Radiation thermometry. |
| **Measuring biopotentials**  Origins of biopotentials; Review of basic electrochemistry; Electrode half-potentials; Electrical equivalent circuits of electrodes. |
| **Measuring chemicals**  pH sensor; Oxygen and Cardon dioxide sensors; Glucose sensors. |

# Course Grading

Assignment: 15%

Quiz: 15%

Midterm: 25%

Final: 50%

# Course Textbook

Webster, John G., ed. Medical instrumentation: application and design. John Wiley & Sons, 2017.