

**Course Code :** EC 732

**Course Title :** Automated Measurements

**Credit Hours :** 3

### **Course Description**

The instrumentation system, Transducers, basic requirements of transducers, structure of Resistive position, and Strain gauge transducers, Linear Variable Differential Transformer, Shaft encoders and Different types of temperature transducers, Photoelectric transducers, Capacitive transducers and Thermal conductivity gas transducer, Humidity Measurements, Ultrasonic level transducers, Hall effect and biomedical transducers, Strain Measurements: constant voltage potentiometer circuit and constant current potentiometer circuit, Wheatstone bridge circuit with constant voltage and Wheatstone bridge circuit constant current circuit, Measurement of sensitivity of strain gauges: single active strain gauge, double active strain gauge, three active strain gauges, four active strain gauges, load wire connections and switching (single pole and three poles switches), Recording Instruments: Direct measurements, Null balance bridges, Wheatstone bridge with oscilloscope and calibration resistance method, Piezoelectric Transducers: Voltage follower circuit, Charge amplifier circuit and Built-in voltage follower circuit, Power supplies and voltage regulators circuits: Batteries, Line voltage power supply, Discrete voltage regulators, Series type and shunt type voltage regulators, IC voltage regulators, Adjustable voltage regulators and performance of power supply circuit (load effect, source effect, temperature effect, drift stability), Signal conditioning circuits: Amplifiers circuits and its characteristics, PID instruments, Seminars and project.

### **Course Objectives**

Understanding the electronic measurements in more sophisticated systems such as automatic measurement and control.

Understanding Different types of transducers and its applications.

Discussing different techniques of strain measurements and sensitivity of gauges.

Illustrate different recording instruments.

Demonstrate the signal conditioning and power supply systems.

Explain different types of piezo electric circuits and its applications

Explain PID instruments and its applications

### **Course Topics**

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| Week no. 1: | The instrumentation system, Transducers, basic requirements of transducers, structure of Resistive position, and Strain gauge transducers. |
| Week no. 2: | Linear Variable Differential Transformer, Shaft encoders and Different types of temperature transducers                                    |
| Week no. 3: | Photoelectric transducers, Capacitive transducers and Thermal conductivity gas transducer.   |
| Week no. 4: | Humidity Measurements, Ultrasonic level transducers, Hall effect and biomedical transducers.   |
| Week no. 5: | Strain Measurements: constant voltage potentiometer circuit and constant current potentiometer circuit.                                    |

- Week no. 6: Wheatstone bridge circuit with constant voltage and Wheatstone bridge circuit constant current circuit.
- Week no. 7: Wheatstone bridge circuit with constant voltage and Wheatstone bridge circuit constant current circuit. / 7<sup>th</sup> week evaluation.
- Week no. 8: Measurement of sensitivity of strain gauges: single active strain gauge, double active strain gauge, three active strain gauges, four active strain gauges, load wire connections and switching (single pole and three poles switches).
- Week no. 9: Recording Instruments: Direct measurements, Null balance bridges, Wheatstone bridge with oscilloscope and calibration resistance method.
- Week no. 10: Piezoelectric Transducers: Voltage follower circuit, Charge amplifier circuit and Built-in voltage follower circuit.
- Week no. 11: Power supplies and voltage regulators circuits: Batteries, Line voltage power supply, Discrete voltage regulators, Series type and shunt type voltage regulators, IC voltage regulators, Adjustable voltage regulators and performance of power supply circuit (load effect, source effect, temperature effect, drift stability).
- Week no. 12: Power supplies and voltage regulators circuits: Batteries, Line voltage power supply, Discrete voltage regulators, Series type and shunt type voltage regulators, IC voltage regulators, Adjustable voltage regulators and performance of power supply circuit (load effect, source effect, temperature effect, drift stability). / 12<sup>th</sup> week evaluation
- Week no. 13: Signal conditioning circuits: Amplifiers circuits and its characteristics.
- Week no. 14: PID instruments
- Week no. 15: Seminars and project.
- Week no. 16: Final Examination

## References

- Larry Jones and A. Foster Chin ,“Electronic measurements and instruments”
- Modern electronic instrumentation and measurements techniques” Albert Helfrick and William Cooper
- “J.B.GUPTA,“ Electronic and Electrical Measurements and Instrumentation “
- John Park and Steve Mackey “Practical Data Acquisition for Instrumentation and control systems”, Newnes publisher, 2003, ISBN: 0750657960
- Nikolay Kirianaky and others “ Data Acquisition and Signal Processing for Smart Sensors”, John Wiley&Sons, ISBN:0470843179

- Ramon Pallaa Sareny, Joun G. Webster, "Sensors and signal conditioning", Joun Wiley & Sons, INC, 2001.