

## **EC410- Electronic Measurements**

### **CREDIT HOURS**

3 Hours

### **CONTACT HOURS (Hours/week)**

Lecture: 2; Tutorial: 2

### **COURSE COORDINATOR**

Dr. Amr Byoumi

### **TEXT BOOK**

GUPTA,J.B., A Course in Electronic & Electrical Measurements & Instrumentations, 13<sup>th</sup> edition, S.K. KATARIA 2005

### **COURSE DESCRIPTION**

Ac signal sources, Oscillators, Selection of an Oscillator, Barkhausen criteria. Audio frequency oscillator (Wien bridge oscillator, Phase shift oscillator), Radio frequency oscillator (Colpitts oscillator, Hartley oscillators), Crystal oscillator. Signal Generator, Sweep frequency generator, Pulse and Square wave generator, Function Generator, Attenuators. Harmonic analysis, Frequency spectrum of waveform, Harmonic distortion. Harmonic Analyzing Instruments, Harmonic distortion analyzer. Wave analyzer, spectrum analyzer. Transducers, classification of transducers, Selecting of Transducer, Strain gauge transducer, Displacement Transducer, Capacitive Transducer, Inductive Transducers, Piezoelectric Transducer, Temperature Transducers, Photoelectric Transducers. Data acquisition system, Signal conditioning circuit. Digital to Analog and Analog to Digital converters. Data acquisition system and computerized control.

### **PREREQUISITE:**

EC 217 - EC 432

### **RELATION OF COURSE TO PROGRAM**

Required

### **COURSE INSTRUCTION OUTCOMES**

The student will be able to:

- Understand the requirements to generate electronic signals .
- Discuss different techniques to stabilize strength and frequency.
- Understand different techniques to measure and calibrate frequency.
- Appreciate the transducers and data acquisition system.

### **TOPICS COVERED**

- Inverting and Non-inverting amplifier. AC signal sources, signal generator, Oscillators. Classification of Oscillators. Requirements of oscillation.

- Audio Frequency Oscillator, Wien bridge Oscillators, Phase shift Oscillators, Frequency, Gain, Feedback Factor and their Applications
- Radio Frequency Oscillators :Colpitts Oscillators, Hartley Oscillators, Crystal Oscillators Frequency, Gain, Feedback Factor and their Applications
- Function Generators, Characteristics of each part and its analysis
- Attenuators circuit, L-type Attenuators, T-type Attenuators, Pi-type Attenuators
- Signal Analysis: Harmonic Distortion, Frequency Spectrum of Harmonic distortion, Harmonic Distortion Analyzer.
- Wave analyzer, Resonance wave analyzer, Heterodyne wave analyzer, Spectrum analyzer, Heterodyne spectrum analyzer
- Transducers, Classification of Transducers, Active and Passive Transducers. Digital and Analog Transducers. Primary and Secondary Transducers. Selection of Transducers.
- Displacement Transducer, Resistive position Transducers and Strain Gauge Transducers.
- Capacitive Transducers, rotary plate capacitor, Recti-linear Capacitor, Diaphragm. Inductive Transducers: Tachometers, Linear Variable Differential Transducer (LVDT)
- Temperature and displacement sensors” Temperature measurement devices and their parameters, Thermistor and Thermometer.
- Photovoltaic theory of operation” Light intensity and definitions ,Dark IV diode characteristics ,Light absorption by semiconductors, Photomultiplier and photoconductive.
- Data acquisition system: signal conditioning circuit: buffering, filtering, signal level change, signal conversion, linearization and multiplexers.
- Analog to digital and digital to analog converter “Analog to digital conversion concept, Digital to analog conversion concept, Multiplexing, Interference problem solvers
- Computer controlled test” Introduction to computer control testing, Case study, Digital control and signal timing concept

**CONTRIBUTION OF COURSE TO MEET THE REQUIREMENTS OF CRITERION 5:**

<b>Professional component Content</b>			
<b>Math and Basic Sciences</b>	<b>Engineering Topics</b>	<b>General Education</b>	<b>Other</b>
	✓		

**RELATIONSHIP OF COURSE TO STUDENT OUTCOMES:**

Student Outcomes	Course aspects	
A	An ability to apply knowledge of mathematics, science, and engineering	a <sub>2</sub>
B	An ability to design and conduct experiments, analyze and interpret data.	
C	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health, and safety, manufacturability, and sustainability	c <sub>3</sub>
D	An ability to function on multi-disciplinary teams.	
E	An ability to identify, formulate, and solve engineering problems	
F	An understanding of professional and ethical responsibility	
G	An ability to communicate effectively	
H	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social content	
I	A recognition of the need for, and an ability to engage in life-long learning.	
J	A knowledge of contemporary issues within and outside the electrical engineering profession.	j <sub>2</sub>
k	An ability to use the techniques, skills, and modern engineering tools necessary for electrical engineering practice.	k