Engineering Metrology

Dr. Anwar Abu-Zarifa
Assistant Professor
Industrial Engineering department
Faculty of Engineering
Islamic University of Gaza
2015
Syllabus and Course Outline

Faculty of Engineering
Department of Industrial Engineering
EIND 3302, Engineering Metrology

Instructor: Dr. Anwar Abu-Zarifa
Office Room: Tel: 2862
eMail: aabuzarifa@iugaza.edu.ps
Website: http://site.iugaza.edu.ps/aabuzarifa
Office Hrs: see my website
Mission of the course

- Enables the students to learn the techniques and standard practices in metrology
- At the end of the lectures, one would be able to:
  - Have clear idea of challenges in metrology due increasing trend towards miniaturization
  - Understand many different metrological devices and principles and applicability of those devices
  - Understand the process and provide metrological solution for the betterment of part or process
Outline of the Course

Lecture Topics

Need for Metrology – an overview
Linear and Geometric Tolerances
Methods in Surface Measurement
Fundamentals of Optical Metrology
Optical interferometry – theory and overview
Moiré and phase shifting interferometry
Speckle Interferometry and Holography
Light sources, detectors and imaging systems
Application to precision measurement and MEMS devices
Special Topics – Nanometrology, Bio Metrology and
Special Topics – Interference spectroscopy and Review
Textbook and References


References:

2. Eugene Hecht: Optics, Addison-Wesley Pub
The Lab

- In order to understand some basic principles and measurement methods available in metrology, a 2 hour lab demonstration will be held during the term.
- Students should get the relevant details and this will be required for doing a project which may have some experiments.
- Note: Safety is of utmost importance. So group of students must work together and will be helped by researchers in the lab.
Chapter 1

Introduction
What is Metrology?

Metrology is the science of measurement, embracing both experimental and theoretical determinations at any level of uncertainty in any field of science and technology.
Why is it important

• When you can measure what you are speaking about, and express it in numbers, you know something about it;
• But when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind.
• It may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science.
A bit of history

- One of the earliest records of precise measurement is from Egypt. The Egyptians studied the science of geometry to assist them in the construction of the Pyramids. It is believed that about 3000 years BC, the Egyptian unit of length came into being.
The "Royal Egyptian Cubit" was decreed to be equal to the length of the forearm from the bent elbow to the tip of the extended middle finger of the hand of the Pharaoh or King ruling at that time.
Although standardization has been a goal of social and economic advancement since very early times, only in 18th century that there was a unified measurement system.

The earliest systems of weights and measures were based on human morphology. Consequently, these units of measurement were not fixed; they varied from one town to another, from one occupation to another, and on the type of object to be measured.

This lack of a standardized system of measurements was a source of error and fraud in commercial and social transactions, putting a brake on international commerce and prevented the development of science as an international endeavor.