King Saud University
Electrical Engineering Department
EE   306: Electrical and Electronic Instrumentations

Second Semester 1425/26 (2004/2005)

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Textbook: "Applied Electronic Instrumentation and Measurement" by David Buchla & Wayne McLachlan , , Macmillan Publishing Company , 866 Third Avenue New York , NY 100212

Description: Concepts of electrical and electronic instrumentations and measurements , data analysis , standards and calibration , analog measurements, oscilloscopes, digital measurements , transducers , data accusation recording and control , noise effects in measurements and instrumentations.

Prerequisite: EE 311.

Co requisites: EE 307.

Course Objectives:

1- Teach the principles of measurement using stat- of – the art electronic instrumentation techniques.

2- Learn the methodologies of data processing , drawing charts , error avoiding or elimination , standards and calibration.

3- Introduce the structures of the basic instruments used in electrical 7 electronic Labs like CRO , Meters , Multimeters , …

4- Define the role of transducers in modern instrumentation with introduction to signal conditioning and adaptation circuits .

5- Understanding the main concepts of digital instrumentation , interfaces , digital displays and computer based instrumentation and data accusations .

6- Understanding the effect of noise on measurements and methods of noise reduction.

Class/Tutorial Schedule: Class is held two times per week in 50-minute lecture sessions. There is also a 50-minute weekly tutorial associated with this course.

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Professional Component Contributions: Students study the modern methods and technologies associated with instrumentation and measurements. They learn the basic principles of measurements, errors, accuracy and precisions, data analysis and graphing. The relation between standards and calibration is essential and helps the student to find the best instrument for a given application. The history of the classical moving coil meters and the development to the modern digital techniques is a good example for the students to see and catch the role of modern electronics in this field and even in other

fields like control and biomedical engineering. The introduction of the basic structure of some frequently used instruments like CRO and digital millimeters puts the student at the first step of designing, testing and calibrating such equipments. The students also have to be award with the new concept of building automatic test equipments based on transducers and computer interfacing. Examples of such applications are given.

Relationship to Program Objectives: This course contributes to the general objectives listed for an Electrical Engineering Department.

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Objective A: By teaching students how to get the basic principles in measurements and explore the internal circuits and components of a given system, this course supports the objective of producing graduates with a strong foundation in basic science.

Objective B: By teaching students how to deal with electrical quantities and their measurements problems, the course helps in the department's production of students with a strong foundation in electrical engineering.

Objective C: By encouraging students to participate in class, acquire basic group dynamics skills and provide personal assessments on other equipments, present their structure and compare them among themselves, this course supports the objective of producing graduates with good communication skills.

Objective D: By teaching the students how to function the knowledge they got from the outside world in imagining and designing instruments,   this course supports the objective of providing graduates with a broad-based education so that they can appreciate diversity of opinion, better understand ethical issues and develop a more global perspective of the profession.

Objective E: By teaching students how to design simple data accusation, control and monitoring schemes, this course supports the objective of producing graduates with the relevant engineering design experience.

Evaluation: There are graded home works, two 2-hour mid-term exams and a three-hour final exam. The course grade distribution is as follows:

> 20% Attendance, in-class quizzes and tutorial home-work
> 40% Two Midterm Exams
> 40% Final Examination

Challenges and Actions Taken to Improve the Course: Some basic background and prerequisite-type material are often reviewed during this course, notably those related to modern techniques in transducers , all digital approaches and built in computer interfaces

Weekly Teaching Plan

1. Measurement principles: Block diagrams of modern measurement system , Signals and waveforms transducers, system response. 1- Week
2- Instruments, transmission path, errors, accuracy and precisions, statistics, data fitting and graphs.   1- Week
3- Standards and calibration   1- Week
 4- Meters & bridges   3- Weeks

5- Oscilloscopes   3-weeks
6- Noise and noise reduction   1-week
7- Transducers   2 weeks
8- Data Acquisition, Recording and control   2 weeks

Prepared by: Dr. Mohamed A. Abou ElEla & Dr. Yassin Khan : Dec. 13, 2003