ME 36500
SYSTEMS AND MEASUREMENTS

Course Outcomes [Related ME Program Outcomes in brackets]
1. Provide a fundamental knowledge of the theory of measurement sciences. [A1, A2, A3]
2. Gain knowledge of the practice and art of measurements through laboratory experiments. [A1, A2, A3]
3. Sharpen skills in problem formulation and integration of a broad range of technical capabilities through certain deliberately ill-defined experimental procedures. [A1, A2, A3]
4. Sharpen technical communication skills through short technical reports. [B1, B2]
5. Develop team skills with measurement design project. [B1, B2]

Static Instrument Characteristics (2 wks)
1. Calibration
2. Digital-to-Analog Conversion
3. Sampling and Aliasing

Statistics (3 wks)
1. Probability Density Functions
2. Sample Statistics & Confidence Intervals
3. Linear Regression
4. Propagation of Error
5. Hypothesis Testing (Chi-Squared Test)

Dynamic Instrument Characteristics (3 wks)
1. Transient and Steady-state Response
2. Frequency Response
3. Bode Plots
4. System Identification

Signal Conditioning & Analysis (5 wks)
Signal Analysis:
1. Fourier Series
2. Spectrum Analysis
3. Signals through Systems

Signal Conditioning:
1. Filters
2. Loading (Impedance Matching)
3. Op Amps
4. Variable Impedance Devices (strain gages) & Bridge Circuits
5. Modulation and Demodulation

Laboratory Experiments
1. Basic Operation of Oscilloscopes, Function Generators, Timer-Counters, and Digital Multimeter
2. Digital Data Acquisition Hardware (A/D & D/A Converters, Op Amps, Quantization, Filters)
3. Introduction to LabVIEW software.
4. Statistics (Prob. Density Functions, Sample Stats, Confidence Intervals)
5. Temperature Measurements (Thermocouples, Calibration, Transient & Steady-State Response, Linear Regression, Propagation of Errors).
6. Frequency Response (Time and Frequency Domain Response, System Identification, Bode Plots)
7. Signal Conditioning and Loading (Filters, Op Amps, Impedance)
8. Freq. Analysis (Sampling, Aliasing Spectrum Analysis, Fourier Analysis)
## 1. Course Number and Name: ME 36500 Systems and Measurements

### 2. Credits and Contact Hours:
- **3 credits**
  - **Lecture:** 2 days per week at 50 minutes for 16 weeks
  - **Laboratory:** 1 day per week for 150 minutes for 16 weeks

### 3. Course Coordinator or Instructor:
- G. B. King

### 4. Textbook:
- Course Notes

### 5. Specific Course Information:
#### a. Catalog Description:
The fundamentals of dynamic system modeling are reviewed with special reference to measurement systems. Analytical and experimental techniques of general importance in systems engineering are presented, including sensor utilization in feedback control. Engineering measurement fundamentals, including digital and frequency domain techniques, noise, and error analysis are covered. Typically offered in fall and spring.

#### b. Prerequisites:
- ME 27400 – Basic Mechanics II
- MA 26200 – Linear Algebra and Differential Equations
- EE 20100 – Linear Circuit Analysis
- EE 20700 – Electric Measurement Techniques

#### c. Status:
- Required

### 6. Specific Goals for the Course
#### a. Course Outcomes:
[Related ME Program Outcomes in Brackets]
1. Provide a fundamental knowledge of the *theory of measurement* sciences. [A1, A2, A3]
2. Gain knowledge of the practice and art of measurements through laboratory experiments. [A1, A2, A3]
3. Sharpen skills in problem formulation and integration of a broad range of technical capabilities through certain deliberately ill-defined experimental procedures. [A1, A2, A3]
4. Sharpen technical communication skills through short technical reports. [B1, B2]
5. Develop team skills with measurement design project. [B1, B2]

#### b. Related ME Program Outcomes:
[Related ABET Outcomes Listed in Brackets]
- A3. Experimental Skills; B5. Life-Long Learning;
- A4. Modern Engr Tools; C1. Leadership,
- A5. Design Skills; C2. Global Engineering Skills;
- A6. Impact of Engr Solns; C3. Innovation;
- B1. Communication Skills; C4. Entrepreneurship
- B2. Teamwork Skills

### 7. List of Topics:
See following page.

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**Prepared By:** G.B. King  
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