

BME 301- Section H01 – Fall 2009
ELECTRICAL FUNDAMENTALS OF BIOMEDICAL ENGINEERING

<p>Week 1a (9/1) - Introduction</p> <ul style="list-style-type: none"> ▪ Review Course Objectives ▪ Discuss studio labs and reports <li style="padding-left: 20px;">– Introduction to The Studios ▪ Electronic Components and Standards: A Practical Review ▪ Breadboard and Multimeter Usage ▪ Lab Instruments (Signal Generator and Voltage Supply) and their Usage 	<ul style="list-style-type: none"> ▪ Week 1b (9/4) <p style="text-align: center;">Class cancelled because of IEEE/ EMBC Conference</p>
<p>Week 2a (9/8) - Resistive Circuits</p> <p>Lecture: (Chapter 8 and 12)</p> <ul style="list-style-type: none"> ▪ Charge, Current, Resistance, Ohm's Law ▪ Resistance in Series, Resistance in Parallel ▪ Resistance in combination (series and parallel) circuits. ▪ Examples 	<p>Week 2b(9/11) - Resistive Circuits</p> <p>Lecture: (Chapter 9)</p> <ul style="list-style-type: none"> ▪ Kirchhoff's current law. ▪ Kirchhoff's voltage law. ▪ Examples <p>Homework#1 assigned</p>
<p>Week 3a (9/15) - Resistive Circuit Lab</p> <p>Studio:</p> <ul style="list-style-type: none"> ▪ Principles of voltage and current measurements <li style="padding-left: 20px;">▪ Measure voltage and current in series circuits <li style="padding-left: 20px;">▪ Build voltage divider and Wheatstone bridge circuits. 	<p>Week 3b (9/18)– Capacitors in DC Circuits</p> <p>Lecture: (Chapter 11 and 13)</p> <ul style="list-style-type: none"> ▪ Capacitance Theory ▪ Charging and Discharging of Capacitance <p>Homework #2 assigned</p>
<p>Week 4a (9/22)- Capacitors in DC Lab</p> <p>Studio:</p> <ul style="list-style-type: none"> ▪ Build RC w/ long time constant ▪ Build RC w/ short time constant ▪ Replace manual switch with function generator 	<p>Week 4b (9/25)- Operational Amplifiers</p> <p>Lecture: (Chapter 10)</p> <ul style="list-style-type: none"> ▪ Inverting Amplifier ▪ Non-Inverting Amplifier ▪ Summing Amplifier
<p>Week 5a (9/29)</p> <p style="text-align: center;">EXAM #1</p>	<p>Week 5b (10/2)</p> <ul style="list-style-type: none"> ▪ Exam Review ▪ Continue on Operational Amplifiers with Examples
<p>Week 6a (10/6) – Operational Amplifiers</p> <p>Studio:</p> <ul style="list-style-type: none"> ▪ Build an Inverting Amplifier and Test with a Sinusoidal signal 	<p>Week 6b (10/9) – Matlab</p> <p>Lecture: Programming in Matlab</p>
<p>Week 7a (10/13) – AC Currents and Frequency Domain</p> <p>Lecture: (Chapter 15)</p> <ul style="list-style-type: none"> ▪ Concepts of frequency, phase, and phasor ▪ Reactive Impedance as a function of frequency ▪ Fourier Transformations ▪ Transfer Function 	<p>Week 7b (10/16) – Capacitors in Sinusoidal AC Currents</p> <p>Lecture:</p> <ul style="list-style-type: none"> ▪ Current and voltage phasors in capacitive circuits ▪ Transfer function of a passive 1st order RC Filter
<p>Week 8a (10/20) – Passive and Active Filtering Lab</p> <p>Studio:</p> <ul style="list-style-type: none"> ▪ Build 1st order passive RC filter (Low-Pass) and plot transfer function. ▪ Build 1st order active RC filter (High-Pass) and plot transfer function. 	<p>Week 8b (10/23) – Bioelectric Phenomena</p> <p>Lecture: (Chapter 14)</p> <ul style="list-style-type: none"> ▪ Nernst Equation ▪ Membrane Resting Potential ▪ Action Potential Generation ▪ Action Potential Propagation
<p>Week 9a (10/27)– Bioelectric Phenomena Lab</p> <p>Studio: U. Chicago web site (membrane potential and action potential propagation)</p>	<p>Week 9b (10/30)– Physiological Signals - I</p> <p>Lecture: (Chapters 7 and 8 from Psychophysiological Recording Book)</p> <p>EEG - Electroencephelogram EMG – Electromyogram ENG – Electroneurogram</p>

<p>Week 10a (11/3)– Physiological Signals - II Lecture: (Chapters 9, 11, 12) EOG – Electrooculogram ERG – Electroretinogram EGG - Electrogastrogram ECG – Electrocardiogram Demo: ECG Recording</p>	<p>Week 10b (11/6) –</p> <p style="text-align: center;">EXAM #2</p>
<p>Week 11a (11/10) – Physiological Signals Lab - I</p> <p style="text-align: center;">Exam review</p> <p>Studio: Electrooculogram Recording Experiment Part I</p>	<p>Week 11b (11/13) – Physiological Signals Lab - II</p> <p>Studio: Electrooculogram Recording Experiment Part II</p>
<p>Week 12a (11/17) - Analog to Digital Conversion</p> <p>Lecture: (Handout)</p> <ul style="list-style-type: none"> ▪ Sampling, Digital Signal Theory ▪ Analog to Digital Converters 	<p>Week 12b (11/20) – Sensors – I</p> <p>Lecture: Resistive sensors. Switch, pot, photocell, strain gauge, thermistor</p>
<p>Week 13a (11/25 Wednesday) – Recording Electrodes</p> <p>Lecture: (Handout)</p> <ul style="list-style-type: none"> ▪ Electrode skin interface model ▪ Electrical circuit equivalent of electrodes ▪ Practical limitation of electrodes ▪ DC half-cell potential and frequency response ▪ Motion artifacts 	<p>Thanksgiving Recess – No Class on Tuesday and Friday</p>
<p>Week 14a (12/1) – Sensors Laboratory</p> <p>Studio: Thermistor - Wheatstone Bridge Temperature Measurement</p>	<p>Week 14b (12/4) - – Sensors – II</p> <p>Lecture: Capacitive Sensors</p>
<p>Week 15 (12/8) - Other Sensors and Transducers</p> <p>Lecture: 1- inductive 2- optical 3- thermocouple 4- Pneumotach</p>	<p>Make-up Class</p> <p>Review of Class Material and Example Solutions</p>

FINAL EXAM will be during officially scheduled time and date.

Class meets from 12:15pm – 2:25pm on Tuesdays and
1:00pm – 3:10pm on Fridays