

Mechatronics 10
Fundamentals of Electronics
Fall 2019– Course Syllabus



Instructor	<p>Steven Gillette: AA – Machine Tool Technology, AA Computer Integrated Electronics, BS – Mechanical Engineering Technology, MS – Engineering Management. <i>Expertise</i> – industrial continuous processes including power generation and water treatment; hands-on installation, repair and troubleshooting of large scale mechanical & electrical equipment, process instrumentation & control devices; advanced maintenance practices including vibration; infrared; ultrasonic analysis; industrial safety including confined space entries, arc flash hazards, control of hazardous energies.</p> <p>Faculty Email Address; sgillette@sierracollege.edu Voicemail; 530 613-8654</p>												
Office Hours	I try to arrive one hour early to class to allow individual attention and open lab prior to class.												
Resources	<p>Required: USB flash drive, scientific calculator (TI-36 or better)</p> <p>Optional: Foundations of Electronics, Circuits and Devices; Russell L Meade</p> <p>Web: https://sierra.instructure.com/login Login using your MySierra username and password.</p>												
Other Materials	Recommended: Digital camera												
Catalog Description	A fundamental study of electronic devices, circuits, and systems as applied to audio, robotics, and computers. Presented through hands-on, project-based experiments.												
Course Format	<p>4 units, 29 classes, 1 ½ hour lecture, & 2 hours lab per class</p> <p>For maximum benefit from this course plan on four to six hours per week of independent study outside the classroom.</p>												
Attendance & Participation	<p>This course consists of a series of lecture and lab exercises. Full on-time attendance is mandatory for all students. Please notify the instructor in advance of planned absences. The instructor may drop students missing more than 4 classes. Students earn participation points through attendance, active engagement in classroom activities, laboratories, independent study, housekeeping, and for assisting other students in the completion of laboratory assignments. Do not use computers during lectures unless directly related to the lecture topic. Turn cell phones and pagers to 'silent' mode, and do not interrupt class by taking calls or text messages while class is in session.</p>												
Quizzes, Tests, Lab Assignments	<p>Quizzes are taken online using the Canvas website dedicated to this class. You have the entire semester (!) to complete the quizzes. Students must complete the quizzes by midnight on December 14, 2019.</p> <p>Laboratory reports are due one week after assignment according to the class schedule listed in this syllabus. Points are awarded for on-time report submittals. Lab partners must complete individual lab reports. Duplicate lab reports will each be assessed a 50% penalty! Students will need to work at home and utilize open lab time to complete the assignments.</p>												
Laboratory Fees	There are no lab fees for this course!												
Academic Regulations	<p>Student Responsibility – The student is ultimately responsible for compliance with all procedures, policies, requirements, schedules, and deadlines of Sierra College, the Business and Technology department, and of the MECH 10 course.</p> <p>Registration – Students must officially register for each course. Failure to register will result in “No Credit” for the units attempted. Students not officially registered may not audit.</p> <p>Withdrawal – Students that stop attending class must officially withdrawal from course through MySierra. Failure to properly withdrawal by the deadline will result in a grade of “F”. Consult the Sierra College Academic Calendar for the last day to withdrawal.</p> <p>Please reference the <i>Students Rights and Responsibilities Handbook</i> for additional information.</p>												
Grades	<p>The final semester grading scale will be:</p> <table border="0"> <tr> <td style="vertical-align: top;">A</td><td>The student has acquired the knowledge and INSIGHT to apply all the course material. No further review, training, or experience is required. (≥ 90% of possible points)</td></tr> <tr> <td style="vertical-align: top;">B</td><td>The student has acquired the knowledge to apply all the course material. Some further review, training or experience is required. (≥ 80 to 89 % of possible points)</td></tr> <tr> <td style="vertical-align: top;">C</td><td>The student has acquired the knowledge to apply some of the course material. Further review, training, and experience is needed. (≥ 70 to 79% of possible points)</td></tr> <tr> <td style="vertical-align: top;">D</td><td>The student has acquired the knowledge to apply some of the course material. Significant additional review, training, and experience is required. (≥ 60 to 69%)</td></tr> <tr> <td style="vertical-align: top;">F</td><td>The student cannot vocationally apply the principles of the course. (< 60%)</td></tr> <tr> <td style="vertical-align: top;">I</td><td>The student has not completed academic work at the end of the semester, because of emergency medical conditions or scheduled military obligations. Poor and/or late performance is not cause for issuing an incomplete. It is the policy of this instructor not to issue incompletes without proof of circumstance.</td></tr> </table>	A	The student has acquired the knowledge and INSIGHT to apply all the course material. No further review, training, or experience is required. (≥ 90% of possible points)	B	The student has acquired the knowledge to apply all the course material. Some further review, training or experience is required. (≥ 80 to 89 % of possible points)	C	The student has acquired the knowledge to apply some of the course material. Further review, training, and experience is needed. (≥ 70 to 79% of possible points)	D	The student has acquired the knowledge to apply some of the course material. Significant additional review, training, and experience is required. (≥ 60 to 69%)	F	The student cannot vocationally apply the principles of the course. (< 60%)	I	The student has not completed academic work at the end of the semester, because of emergency medical conditions or scheduled military obligations. Poor and/or late performance is not cause for issuing an incomplete. It is the policy of this instructor not to issue incompletes without proof of circumstance.
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Weighting	Final grades will be calculated based on available points from class activities (subject to change)	
	Worksheets	150 points
	Laboratories	1390 points
	Quizzes	780 points
	Participation	250 points
Total Points	Portfolio	<u>250 points</u>
		≈ 2820

Safety

Safety is of the utmost importance in this class. The hand tools, machine tools, and electrical devices used in this class can cause **severe injury** if misused. If you are not certain how to use a tool or electrical device safely, it is your responsibility to ask the instructor or lab assistant for help. Do not use tools or electrical devices unless you completely understand the safe use of the equipment. Notify the instructor if you have any questions or comments regarding your safety and the safety of your fellow students. Notify the instructor immediately in case of injury. Notify the instructor or lab assistant of broken lab equipment. Do not attempt to repair lab equipment.

Open toed shoes are prohibited in the lab areas!

If you have any ongoing health issues that may affect your safety and well being in this class, please discuss them with the instructor to insure prompt and effective response.

Student Learning Outcomes

1. Construct and analyze functional electronic circuits from schematic diagrams
2. Evaluate results from electronic multi-meters and oscilloscopes
3. Construct and evaluate electronic circuits built using solder

Mechatronics 10 – Class Schedule

Lab #	Lecture Topic	Agenda	Date
Week 01			
1	Introduction	Classroom Procedures; Introduction to Mechatronics; Lab Demonstrations Lab – Astable Multivibrator Circuit	08/27
2	Electricity	Atomic Structure; Charge & Force; Circuit Elements; Circuit Components; Schematic Diagrams; Grounds; Lab – Shock Current Path	08/29
Week 02			
3	Electrical Units of Measure	Mass, force, work; voltage; current (conventional & electron flow); resistance; capacitance; inductance; power; engineering notation; significant figures Lab – Basic Multimeter Function Worksheet – Engineering Notation	09/03
4	Ohm's Law	Ohm's Law Relationships (current, voltage and resistance) Lab - Ohm' Law Validation Worksheet – Ohm's Law	09/05
Week 03			
5	Joule's Law	Work, energy, power, Watt's Law; power to current, voltage and resistance relationships Lab – Wire Challenge Quiz 01 – Electrical Fundamentals	09/10
6	Series Circuits	Kirchoff's voltage law; voltage dividers, circuit analysis Lab – Series Circuits Worksheet – Series Circuits	09/12
Week 04			
7	Parallel Circuits	Kirchoff's current law; circuit reduction & analysis Lab – Parallel Circuits Worksheet – Parallel Circuits	09/17
	Open Lab	Open Lab	09/19
Week 05			
8	Series – Parallel Circuits	Circuit reduction & analysis Lab – Combination Circuits Worksheet – Combination Circuits	09/24
9	Batteries	Chemistry, specific energy, capacity, power costs, charging methods, cell internal resistance Lab – Batteries Quiz 02 – Series & Parallel Circuits	09/26
Week 06			
10	Electromagnetism	Definitions and terms, units of measure, symbols & formulas, moto & generator action, Faraday's Law, Lenz's Law Lab – Light Activated Switch	10/01
11	Alternating Current	Generation, sine waves, period & frequency, current & voltage values, oscilloscope measurements Lab – Oscilloscope	10/03
Week 07			
12	Reactive Components - Inductors	Construction; series & parallel inductance; stored energy; L/R time constant; transformer action; voltage and current ratios Lab - Transformers Quiz 03 – Electromagnetism	10/08
13	Reactive Components - Capacitors	Types & construction, electrostatic fields, charge & discharge, units of measure, series & parallel capacitance, RC time constant Lab – RC Time Constants	10/10
Week 08			
14	Capacitive Reactance	VI relationships; capacitive reactance X_C ; impedance Z ; series RC frequency filters Lab – High & Low Pass Filters	10/15
	Open Lab	Open Lab	10/17
Week 09			
15	Inductive Reactance	VI relationships; inductive reactance X_L ; impedance Z ; series RL frequency filters Lab – Phase Shift	10/22
16	Resonance	Series resonance; parallel resonance; resonant frequency; resonant rise; Q; band pass & band stop filters Lab – Band Pass Filter Quiz 04 – Reactive Components	10/24

Lab #	Lecture Topic	Agenda	Date
Week 10			
17	Semiconductor Fundamentals	Materials; P-N junction; biasing P-N junctions; characteristic curves Lab – Diode Performance	10/29
18	Diodes & Rectifiers	Diode types, half-wave, full-wave & bridge rectifiers; capacitive filtering Lab – Half & Full Wave Rectifiers	10/31
Week 11			
19	Power Supplies & Regulation	Power supply types, line & load regulation Lab – MagLev Assembly & Test	11/05
20	BJT Transistors	Types; bias voltage & current; applications; characteristic curves; ratings Lab – Transistor Beta	11/07
Week 12			
21	BJT Transistor Drivers	Transistor saturation; Lab – Transistor Driver	11/12
	Open Lab	Open Lab	11/14
Week 13			
23	BJT Amplifiers	Transistor amplification; circuit configurations; classification of signal levels; circuit analysis Lab – Transistor Voltage Divider Bias Quiz 05 – Semiconductors	11/19
24	JFET, MOSFET, Thyristor	Construction; applications; characteristic curves; circuits Exercise – MOSFET	11/21
Week 14			
		Dad's 90th Birthday	11/26
	Holiday	Thanksgiving!	11/28
Week 15			
25	Operational Amplifiers	Background; ideal characteristics; inverting & non-inverting amplifier; input modes; applications Exercise – Negative & Positive Feedback OpAmp	12/03
26	Digital Gates	Background; ideal characteristics; inverting & non-inverting amplifier; input modes; applications Exercise – Digital Gates	12/05
Week 16			
26		Open Lab (MagLev)	12/10
		Open Lab (MagLev)	12/12
12/14	Semester End		Date

EMERGENCY PROCEDURES FOR FACULTY AND INSTRUCTIONAL SUPPORT STAFF

Faculty and instructional staff members are responsible for the safety and well-being of students during scheduled instructional activities. It is expected that each semester, faculty will notify their students of Sierra College emergency procedures both verbally and in the course syllabus.

IF AN EMERGENCY OCCURS IN THE IMMEDIATE AREA, FACULTY SHOULD CALL FOR HELP.

EMERGENCY TELEPHONE NUMBERS

Fire, Medical, Police Emergencies

Rocklin Campus

Campus Police – Extension 1111 from campus phones, or **(916) 781-0570**

or

Rocklin Police, Fire, Rescue – Dial 911

Nevada County Campus

Campus Police – Extension 1111 from campus phones, or **(916) 781-0570**

or

Grass Valley Police, Fire, Rescue – Dial 911

Roseville Gateway

Roseville Police, Fire, Rescue – Dial 911

Truckee Center

Truckee Police, Fire, Rescue – Dial 911

In the event of a campus emergency, lines of authority may change. Staff will be expected to follow the direction of those who have been placed in charge of specific functions relating to the emergency. Staff will be contacted as appropriate regarding the situation and given instructions on further actions needed.

IMPORTANCE OF ATTENDANCE DOCUMENTATION

In the event of an emergency, it is vital to be able to account for the whereabouts of all students, faculty, and staff. Faculty who take attendance should keep rosters with them and turn them over to the appropriate authority upon demand. Faculty who do not regularly take attendance should work with students to develop some method of accounting for all of the students in the section.