Physics for Environmental Control Technology
Laney College
Summer 2010
June 29 – July 31, 2010
(Note that the outline below is subject to change.)

Course Objectives: Students will:

Understand the main factors effecting building performance and energy use
Learn physics concepts, principles and theories with application to Environmental Control Technologies (ECT) and Building Science
Be introduced to career opportunities in ECT, Energy Efficiency, and Building Science
Develop skills and knowledge needed for success in the ECT curriculum at Laney College

Grading

Weekly Quizzes	15%
Teamwork and Participation in Projects	15%
Weekly Journal	10%
Final PowerPoint Presentation	25%
Skill Demonstration	10%
Final Exam	25%

Daily Time Schedule Monday-Thursday

Session A	8:30 am to 10:30 am
Session B	10:40 am to 12:00 pm
Lunch	12:00 pm to 12:30 pm
Session C	12:30 pm to 3:30 pm

Some Fridays will have required field trips that will be shorter or longer than a regular day, and may have optional or required lab hours.

Course Outline and Content

Week 1 Safety Training
Heating and Cooling
Physical principles of heat transfer and heat content
Solids, liquids and gases – phase change
Introduction to building heating and cooling systems and equipment
Principles of refrigeration
Problem-based learning: Introduction to building systems and design, global warming, and energy resources

Week 2 Heat and Thermodynamics
Heat Capacity
Thermal Conductivity
Brazing and Soldering
Problem-based learning: Energy efficiency strategies, ecological footprint, energy uses in buildings, building performance and comfort

Week 3 Lighting
Introduction to properties of light and the electromagnetic spectrum
Electrical systems, lighting and occupant comfort study
Applications of Motors in HVAC systems, wiring motors
Brazing & Soldering
Problem-based learning: Lighting for comfort and energy efficiency, commercial case studies

Week 4 Electricity and Magnetism
Physical Principles of Electricity and Magnetism
Motors
Building operation and management in a digital world
Principles and Practices in Refrigeration
Heat, temperature and occupant comfort study
Problem-based learning: Building simulations, home energy audit, case studies

Week 5 Energy and Power
Introduction to Energy and Power and Energy Conversion (First and Second Laws of Thermodynamics)
Energy Gains and Losses and Conversions in Buildings
Principles and Practices in Refrigeration
Energy Services and Costs in Buildings
Refrigeration standards and their impact on energy use in America
Electrical systems, windows lighting and occupant comfort study
Problem-based learning: case studies

Course Structure

I. Principles of Physics Lab – Lesia Whitehurst
II. Applications in Environmental Control Technology –Nick Kryiakopedi
III. Building Software Simulations - staff
IV. Energy Efficient Buildings Field Trips – staff
V. Project Based Learning and case studies: Barbara Widhalm and Laney staff

Guest Presenters

Field Trips

PG&E Energy Center – Ryan Stroupe
David Brower Center, Berkeley
More field trips TBD

Week 1

Monday June 25	**Tuesday June 26**	**Wednesday June 27**	**Thursday June 28**	**Friday June 29**
A – Welcome Warm Up Activities Course Overview Keeping a Journal Lesia Nick Barbara	Introduction to Environmental Control Lab and Safety Fundamentals of Refrigeration and HVAC	Intro to Raytec thermometers Hot and Cool Roof Activity (Rollie Otto)	Fundamental of Refrigeration and HVAC	Physics Lab Heat and Temperature
B – *Intro to Project-Based Learning Activity*	Introduction to Careers in HVAC Fundamentals of Refrigeration and HVAC	Solids Liquids and Gases Periodic Table (Rollie Otto)	Fundamentals of Refrigeration and HVAC	Physics Lab Heat and Temperature
C - Introduction to hands-on physics lab	*PBL:* *Introduction to building systems, performance and resource use* *(Rick Diamond)*	Physics Lab Heat and Temperature	*PBL:* *- Buildings and global warming* *- Global energy consumption* *(Robert Van Burskirk, LBNL)* *- Homework: ecological footprint exercise*	Heat Transfer Lab Integrated Quiz

Week 2

Monday July 2	Tuesday July 3	Wednesday July 4	Thursday July 5	Friday July 6
A *Tour: PG&E Training Center* *Ryan Stroup: Host*	Brazing and Soldering/*PBL* *- Review ecological footprint results* *- Energy resources (California) and use by sector* *- Typical energy end use breakdown in buildings (commercial, residential)*		Brazing and Soldering/*PBL* *- Building performance: Comfort, air quality, lighting* *- Building terminology*	Physics Lab Heat and Thermodynamics
B *Tour to PG&E Learning Center*	Brazing and Soldering / *PBL* *- Review ecological footprint results* *- Energy resources (California) and use by sector* *- Typical energy end use breakdown in buildings (commercial, residential)*		Brazing and Soldering/*PBL* *- Building performance: Comfort, air quality, lighting* *- Homework: Building terminology*	Physics Lab Heat and Thermodynamics
C *PG&E debrief*	Physics Lab: Heat and Thermodynamics (Lesia) /Motors		Physics Lab: Heat and Thermodynamics (Lesia) / Motors	Labs Quizzes

Week 3

Monday July 9	Tuesday July 10	Wednesday July 11	Thursday July 12	Friday July 13
A Physics Lab Lighting	Brazing and Soldering/*PBL* *- Energy efficient lighting options for commercial buildings* *- Green building criteria*	Physics Lab – Energy	Brazing and Soldering/*PBL:* *- Commercial case studies independent research*	Physics Lab – Energy
B *- Tour of Mechanical Rooms* *- Peralta's plans for retrofits*	Brazing and Soldering/*PBL* *- Energy efficient lighting options for commercial buildings* *- Green building criteria*	Physics Lab – Energy	Brazing and Soldering/*PBL:* *- Commercial case studies independent research*	Physics Lab – Energy
C *1 – 3 p.m.* *Guest speaker: David Lehrer: Green Design.*	Motors	*PBL: Ryan Stroupe: walk-through of Laney Tower with measuring tools*	Motors	Presentations

Week 4

Monday July 16	Tuesday July 17	Wednesday July 18	Thursday July 19	Friday July 20
A Physics Lab Electricity and Magnetism	Charging and Recovering/ *PBL* *Software for building performance*	Physics Lab Electricity and Magnetism	Charging and Recovering/ *PBL* *Preparing for a home energy audit*	Physics Lab Electricity and Magnetism
B Physics Lab Electricity and Magnetism	Charging and Recovering/ PBL *Software for building performance*	Physics Lab Electricity and Magnetism	Charging and Recovering *PBL* *Preparing for a home energy audit*	Physics Lab Electricity and Magnetism
C Physics Lab Electricity and Magnetism	*Field Trip 2*	Physics Lab Electricity and Magnetism	*Ghana case study:* *(Robert VanBuskirk)*	Labs Quizzes

Week 5

Monday 23	Tuesday July 24	Wednesday July 25	Thursday July 26	Friday July 27
A Physics Lab Motors, Power and Work	*PBL* *Small group work: commercial case studies*	Physics Lab Motors, Power and Work	Exam and Presentation Preparation	Final Exam
B Physics Lab Motors, Power and Work	Loose ends	Physics Lab Motors, Power and Work	Exam and Presentation Preparation	Presentations
C *PBL* *Small group work: - Debriefing home energy audit findings, Continuing commercial case studies*	*PBL* *Commercial Building Case Studies*	*Case study debrief*	Exam and Presentation Preparation	Presentations