1. Course Title:

Applied Thermodynamics
MET 314 and MET 314L– 4 Credits Lecture, 1 Credit Lab

Four hours lecture per week, 2 hours Lab per week
MET Core Program Requirement
Prerequisite: PHYS 182 or PHYS 112 and MATH 173; corequisite MET 314LAB
This is a Technical content course under ABET Criterion 5

2. Faculty Member Information:

Instructor: Roger Beardsley
Office: Hogue 302
Phone: 509- 963-1596
E-mail: beardslr@cwu.edu

3. Course Description:

Properties of pure substances, first and second laws of thermodynamics, enthalpy and entropy, perfect gases, Carnot cycle, steam cycles, refrigeration cycles, mixtures of perfect gases, chemical reactions and combustion

4. Textbook and other required materials for the course:

Fundamentals of Thermal-Fluid Sciences, 2nd Edition Cengel, Yunus and Turner, Robert
McGraw Hill, 2005 ISBN 0-07-297675-6

Other Resources: Internet access, word processing, spreadsheet and graphing capability required.

5. Specific Learner and Expressive Outcomes and Assessment Strategies:

ABET Outcome Criteria #	Learner Outcome The student will:	Assessment Strategy Students shall be assessed through:
9f,h,i,k	1. develop an understanding of the practical aspects of thermodynamics by relating theory to various applications of energy conversions systems.	written homework assignments and examinations.
3b 9f,h,i,k	2. learn the fundamentals of various state-of-the-art energy conversion systems such as steam power plants, spark ignition & compression ignition engines, gas turbines.	written homework assignments and examinations.
3b, 9f,k,o	3. demonstrate an engineering understanding of refrigeration and air conditioning systems.	homework assignments, quizzes, and laboratory experiments and reports.
3g 9h,i,k,o	4. learn terminology in the energy conversion technical field so that the may read, discuss and comprehend the relevant literature.	homework assignments, quizzes, and laboratory experiments and reports.
3f 9f,k,n	5. demonstrate the capability of predicting and measuring the performance of energy conversion systems.	homework assignments, quizzes, and laboratory experiments and reports.
3a,b,c,e 9e,k,n	6. demonstrate the ability to plan and conduct energy conversion experiments.	laboratory experiments and reports.
3a,b,c,e 9e,j,k	7. demonstrate the ability to select proper instrumentation to support experiments and have the ability to calibrate various sensors and connect sensors to data acquisition systems.	laboratory experiments and reports.
3f 9k	8. perform computerized data analysis and be able to present and explain experimental results with clarity.	laboratory experiments, written and oral reports.
3g	9. demonstrate the ability to write various types of test reports common in the engineering field.	laboratory written reports.
3e,j	10. As a result of this course, become a better informed citizen who can take a leadership position when discussions arise dealing with energy issues.	laboratory experiments, written and oral reports.

6. Course Topics and Schedule:

Problem Solving, Accuracy & Precision, Energy Sources, Thermo States & Processes, Terms
Lab 1: Energy Consumption Analysis
Temp & Pressure, Manometers & Atm Press, Pure Substances & Saturation, Property Diagrams
Lab 2: Temperature Measurements Lab
Property Tables & Enthalpy, Ideal Gas & Compressibility Factor,
Specific Heats, Internal Energy of Gasses, Energy Transfer, Work & Heat
Lab 3: Pressure Measurements
Mechanical Work, Conservation of Mass, Flow Work
First Law, Energy Balance for Closed Systems, Energy/Mass Balance, Steady & Unsteady Flow
Lab 4: Vaporization & Latent Heat of R134a
Second Law Intro, Heat Engines, Energy Efficiency, Refrigerators & Heat Pumps
Carnot Cycle & Principles,HeatEngine & Refrig
Lab 5: First Law Experiment
Entropy Increase & Change, Isentropic Processes, T-s diagram, Reversible Work, Entropy Balance
Lab 6: CWU Boiler Plant Tour
Combustion Processes & Chemistry Balance,Stoichiometric Air/Fuel Mixt Adiabatic Flame Temp
Power Cycles, Ideal Otto, Diesel, & Brayton Cycles, Ideal Rankine Cycles, Actual Cycles
Increasing Cycle Efficiency, Reheat
Ideal Refrigeration & Heat Pumps, Actual Systems
Gas Mixtures & Properties, Partial Press/Vol, Air, Relative Humidity, Wet Bulb Temp, Psych Chart
Renewable & Alternative Energy, Emerging Energy Technologies

7. Grading:

Grading Policy:	HW / Quizzes		30%	
	2 Exams & Final	(3)	40%	
	Lab Reports & Memos	(5)	20%	
	Participation/involvement	(30)	10%	(weightings are approx)

A(92-100), A-(90-92), B+(88-90), B(82-88), B-(80-82), C+(78-80), C(72-78), C-(70-72), D+(68-70), D(62-68), D-(60-62), F(<60)

8. ADA Statement:

Students who have special needs or disabilities that may affect their ability to access information and or material presented in this course are encouraged to contact me or Robert Harden, ADA Compliance Officer, Director, ADA Affairs and Students Assistance on campus at 963-2171 for additional disability related educational accommodations.

Prepared by Roger Beardsley June 24, 2009