COURSE OUTLINE
THERMAL PHYSICS

TEXTBOOK
Thermodynamics: An Engineering Approach 4th Edition International Edition By *YUNUS A. CENGEL & MICHAEL A. BOLES. Additional materials provided as required.*

This class meets for 3 hours on Weds or Thursdays for the Jul 2005 session.

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WEEK 1 (July 11th – July 15th)
Knowing Yourself: Index of learning styles & Force Concept Inventory

WEEK 2 (July 18th – July 22nd)
Getting acquainted & Introduction
How to do Concept Map??
Format: Lecture/Group Discussion/Concept Map
1.0 Introduction to thermodynamics
- 1.1 Thermodynamics and energy
- 1.2 A note on Dimensions & Units
- 1.3 Closed and opened systems
- 1.4 Properties of a system
- 1.5 State and equilibrium
- 1.6 Processes and cycles
- 1.7 Forms of energy
- 1.8 Energy & Environment (Sugg. Reading)
- 1.9 Temperature & Zeroth Law of Thermo
- 1.10 Pressure
- 1.11 The Manometer (Suggested Reading)
- 1.13 Problem-Solving Technique

Read Assgn/Concept Map 1: CHAPTER 2 (Part 1) due by 3:00pm July 26th.

WEEK 3 (July 25th – July 29th)
Format: Concept Introduction, Collaborative Learning/ Reinforcement/Lecture-Discussion
2.0 Properties of pure substances
- 2.1 Pure substance
- 2.2 Phases of pure substance
- 2.3 Phase change processes of pure substances
- 2.4 Property diagrams (T-v) for phase change processes
- 2.5 Property Tables (Compressed Liquid & Superheated Vapor)

Read Assgn/Concept Map 2: CHAPTER 2 (Part 2) due by 3:00pm Aug 2nd.

WEEK 4 (Aug 1st – Aug 5th)
Format: Consultation/Concept Introduction, Collaborative Learning/Reinforcement/Lecture-Discussion
- 2.5 P-v diagrams & Property Tables (Wet Mix Phase & more)
- 2.6 The Ideal-Gas Equation of State
- 2.7 Compressibility factor
- 2.8 Other equations of State
- 2.9 Specific Heats

Problems: ***1C till 7C, 17C, 19C till 24C***, 26, 30, ***32***, *50*, 57, ***68***.
QUIZ 1
Read Assgn/Concept Map 3: CHAPTER 3 due by 3:00pm Aug 9th.

WEEK 5 (Aug 8th – Aug 12th)
Format: Consultation/Concept Introduction, Collaborative Learning/ Reinforcement/Lecture-Discussion.
3.0 Energy Transfer by Heat and Work & Mass
- 3.1 Heat as a form of energy (Also read methods of heat transfer).
- 3.2 Energy Transfer by Work
- 3.3 Mechanical forms of work (moving boundary)
- 3.4 Non-mechanical Forms of Work
- 3.5 Conservation of Mass Principle
- 3.6 Flow Work and the Energy of a Flowing Fluid

PROBLEMS: ***1C till 7C, 10C till-13C***, 14, ***15***, 18, ***19***, ***29***, ***35C***, ***36C*** 37, ***45C till-48C***, 50, 53, ***57C till-59C, 62***
QUIZ 2

Read Assgn/Concept Map 4: CHAPTER 4(1) Closed system -due by 3:00pm Aug 16th.

WEEK 6(Aug 15th – Aug 19th)
Format: Consultation/Concept Introduction, Collaborative Learning/ Reinforcement/Lecture-Discussion.
4.0 First Law of Thermodynamics
- 4.1. The First Law of Thermodynamics
- 4.2. Energy balance for closed systems

PROBLEMS: ***1C***, till ***4C***, 5, ***7***, 11, ***12***, 18, 20, ***21***. 27, 28

WEEK 7 (Aug 22nd – Aug 26th).
TEST 1 at DKA or DKB.

Read Assgn/Concept Map 5: CHAPTER 4(2) - Control Volume due by 3:00pm Aug 26th)

WEEK 8 (Aug 29th – Sept 2nd).
Mid Semester Break

WEEK 9 (Sept 5th – Sept 9th).
Format: Consultation/Concept Introduction, Collaborative Learning/ Reinforcement/Lecture-Discussion.
- 4.3. Energy Balance for Steady-Flow systems
- 4.4. Some steady-flow engineering devices
- 4.5. Internal energy, enthalpy, and specific heats for solids and liquids

PROBLEMS: *56C till 60C*, *61*, **74,** *75C till 77C, 79*, **81,** *91*, *92C till 95C,* **96,** *97, 101C till 103C, 105, 110.*
QUIZ 3

Read Assgn/Concept Map 6: CHAPTER 5(1) Second law–Heat engines - due 3:00pm Sept 13th.

WEEK 10 (Sept 12th – Sept 16th)
Format: Consultation/Concept Introduction, Collaborative Learning/ Reinforcement/Lecture-Discussion
5.0 The Second Law of Thermodynamics
- 5.1 Introduction to the second law
- 5.2 Thermal energy reservoirs
- 5.3 Heat Engines
  - 5.31 Thermal Efficiency
  - 5.32 Can we save Q_{out} ?
  - 5.33 The Second Law: Kelvin –Planck Statement
- *5.4 Energy Conversion & Efficiencies (Suggested Reading)*
- 5.5 Refrigerators and Heat Pumps
  - 5.41 Coefficient of Performance
  - 5.42 Heat Pumps
  - 5.43 The Second Law: Clausius Statement
  - 5.44 Equivalence of the two statement
- *5.6 Perpetual-Motion Machines: Suggested reading*
- 5.7 Reversible and Irreversible Processes
  - 5.71 Irreversibilities
  - 5.72 Internally and externally reversible processes
- 5.8 The Carnot Cycle
  - 5.81 The Reversed Carnot Cycle
- 5.9 The Carnot Principles
- 5.10 The Thermodynamic Temperature Scale
- 5.11 The Carnot Heat Engine
  - *5.111 The Quality of Energy (Suggested Reading)*
  - *5.112 Quantity Versus Quality in Daily Life (Suggested Reading)*
- 5.12 The Carnot Refrigerator and Heat Pump

TEST 2 Sept 19th 8:30pm till 10:00pm) DKA or DKB.

PROBLEMS: ***5C***, 9C, ***10C***, ***13C till 16C***, 17, ***18***, ***40C till 47C***, 50, ***54***, ***62***
PROBLEMS: ***67C, 73C till 75C, 80***, 82, 87, ***89C, 90C, 93C***, 95, ***98*** 104, ***108***

Read Assgn/Concept Map 8: CHAPTER 6 - Entropy - due by 3:00pm Sept 20th.

WEEK 11 (Sept19th – Sept 23rd)
Format: Consultation/Concept Introduction, Collaborative Learning/ Reinforcement/Lecture-Discussion.
6.0 Entropy
- 6.1 Entropy
- 6.2 The Increase of entropy Principle
- 6.3 Entropy change of pure substances
- 6.4 Isentropic Processes
- 6.5 Property diagrams involving entropy
- 6.6 What is entropy?
- 6.7 The T-ds relations
- 6.8 Entropy change of liquids and solids (Read)
- 6.9 Entropy change of ideal gases (Read)
- 6.13 Entropy balance

Problems: ***1C till 23C, 24***, 26, ***29***, ***32***, 38, 113.
QUIZ 4
Read Assgn/Concept Map 9: CHAPTER 11 - due by3:00pm Sept 27th

WEEK 12 (Sept 26th – Sept 30th)
Format: Consultation/Concept Introduction, Collaborative Learning/ Reinforcement/Lecture-Discussion
11.0 Thermodynamic Property Relations
- 11.1 Partial Derivatives
- 11.2 Maxwell Relations
- 11.3 The Clapeyron Equations
- 11.4 General relations for *du, dh, ds,* C_v, C_p
- 11.5 The Joule-Thomson Coefficient.
- 11.6 The Dh, Du, Ds, of Real Gases.

PROBLEMS:
QUIZ 5
Read Assgn/Concept Map: Due Oct 4th

WEEK 13 (Oct 3rd – Oct 7th)
Format: Lecture-Discussion
Application of thermodynamics to other systems: chemical potential, surface tension, reversible voltaic cell, blackbody radiation, magnetism.
Read Assgn/Concept Map: Due Oct 12th

WEEK 14 (Oct 10th – Oct 14th)

Format: Lecture-Discussion
Kinetic theory of gases
The development of an equation of state for particles in a 3D box to relate the kinetic energy and the system's temperature will be derived and proven. Its relation to specific heat capacity will also be shown. Concepts of intermolecular forces and mean free path shall be probed and discussed.

WEEK 15 (Oct 17th – Oct 23rd)
TEST 3 (Weds Oct 19th 3:15 pm till 4:30 pm)

Oct 24th – Oct 30th
DEAD WEEK –HELP AVAILABLE DURING CLASS HOURS

Oct 31st – Nov 6th
DEAD WEEK –HARI RAYA BREAK

FINALS (Nov 7th – Nov 25th)

Nov 26th – December 25th SEMESTER BREAK

NOTE: Since 50% of all the tests and the final will incorporate problem-solving skill based on conceptual understanding, your comprehension of the subject matter is highly significant before you try to solve any problems. Hence, you need to practice doing the assigned problems while brushing your understanding of the subject matter. The other 50% will concentrate on sketching, drawings, labelling, and writing down concepts both in your own words and its mathematical representation. Your ability to sketch, label and draw & concept mapping will determine how much you understood the subject matter and in most cases the questions that are asked of you and will also indicate your success in the course.

ASSESSMENT

TESTS	3 x 10%	= 30%
Read Assgn/Concept Map	10 x 0.5%	= 5%
QUIZ	4 x 2%	= 8%
Pre & Post assessment	7 x 1%	= 7%
FINAL EXAM	1 x 40%	= 50%

Read Assgn/Concept Map

ALL the assignment must be submitted no later than 3:00pm on Tuesdays. Your handwriting must be legible. Remember that this is only a summary of the chapter. Hence, I anticipate you to draw concept maps, draw, label, draw again and write down conceptual ideas. In addition, the mathematical representation for how the concepts are related and maybe some derivation on how to represent the concepts mathematically, must also be included, where applicable. *DO NOT COPY ALL THAT YOU SEE IN YOUR TEXTBOOK. SUMMARIZE THEM*. A good summary should not be more than 3 page long with lots of drawings and labeling or concept/mind mapping. You receive credit for each assignment that you submit.

PROJECT (PEER FACILITATING)

Assessment Component

Before class time (Tues or Weds by 3pm) you must email me your responses to each of the outcome listed in the peer-facilitating assessment for each of the topic for the week. This will help me identify those of you who didn't do your preparation or who don't comprehend and which parts you didn't understand. I shall try to do a statistical analysis to try and assist you in your learning. After class, you will again email me your responses. This is the post assessment to check on whether there has been any change in your cognitive structure. Sending a pair, the pre assessment and the post assessment is worth 1%. Failure to send a pair (example, pre only or post only) will not earn you any points. If you didn't sent via email due to network problem, then be sure you bring your responses to class so I can copy onto my laptop.

Important Dates:

Months	Pre & post assessments	Reading Assignment	Quizzes	Tests
July	26 &29	26		-
Aug	2 & 5 9 & 12 17 & 19	2 9 17, 26	Quiz1: 3 or 4 Quiz2: 10 or 11	Test 1; 24th 3:30pm or 25th 2:30pm
Sept	6 & 9 13 & 16 20 & 23	13, 20, 27	Quiz 3: 7 or 8 Quiz 4: 21 or 22 Quiz 5: 28 or 29	Test2:19th Monday night 8:30pm
Oct		4, 12		Test 3:19th Weds 3:30pm

Self Assessments sent via email with your excel file attached.

Pre assessment: Received Tuesdays by 3 pm.
Email Thermopre@salam.uitm.edu.my

Post assessment: Received Fridays by noon.
Email: Thermopost@salam.uitm.edu.my

Meaningful learning = Active learning = self + peer dialogs