COURSE OUTLINE
THERMAL PHYSICS

TEXTBOOK

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

Lecturer: Associate Prof. Dr. Jaafar Jantan a.k.a. Dr. JJ
Room: 516, Level 5, FSG Phone: 5544-4593 or 019-355-1621
Email: drjjlanita@hotmail.com or drjjlanita@yahoo.com or jjnita@salam.uitm.edu.my
Special: Thermopre@salam.uitm.edu.my
Website: http://www3.uitm.edu.my/staff/drjj/

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 Assign/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 steady-flow engineering devices

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 Assign/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 Qout?
5.33 The Second Law: 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 15th 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 Assign/Concept Map 8: CHAPTER 6 - Entropy - due by 3:00pm Sept 20th

WEEK 11 (Sept 19th – 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 Assign/Concept Map 9: CHAPTER 11 - due by 3:00pm 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)
## ASSESSMENT

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<td><strong>FINAL EXAM</strong> 1 x 40%</td>
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### Read Assign/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:

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<th>Months</th>
<th>Pre &amp; post assessments</th>
<th>Reading Assignment</th>
<th>Quizzes</th>
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<td>Aug</td>
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<td>Test 3: 19th Weds 3:30pm</td>
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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