



## UNIVERSITI TEKNOLOGI MARA

### CMT458: CHEMICAL THERMODYNAMICS

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| <b>Course Name (English)</b>  | CHEMICAL THERMODYNAMICS <b>APPROVED</b>  |
| <b>Course Code</b>  | CMT458   |
| <b>MQF Credit</b>   | 3  |
| <b>Course Description</b>   | This course is aimed at providing students the basic concepts of thermodynamics and applying these concepts to solve problems related to actual situation. The topic begins with an introduction to units and dimensional analysis, properties of pure substances, the three laws of thermodynamics and the free energy functions. |
| <b>Transferable Skills</b>  | Understand the link between energy and its functions   |
| <b>Teaching Methodologies</b>   | Lectures, Blended Learning, Case Study, Discussion, Self-directed Learning   |
| <b>CLO</b>  | CLO1 Explain the basic concepts and the terms used in chemical thermodynamics<br>CLO2 Analyze the basic phenomenon, concept and theories of thermodynamics<br>CLO3 Correlate the knowledge of this subject to solve related problems in other subject  |
| <b>Pre-Requisite Courses</b>  | No course recommendations  |
| <b>Topics</b>   |  |
| <b>1. 1. INTRODUCTION</b><br>1.1) 1.1 Scope of subject<br>1.2) 1.2 Terms and definitions: system, intensive and extensive properties, state and path functions, processes, reversible, equilibrium<br>1.3) 1.3 Form of energy : Internal, Kinetic, Potential, Nuclear<br>1.4) 1.4 Energy and environment : Ozone and smog, Greenhouse effect  |  |
| <b>2. 2. PROPERTIES OF PURE SUBSTANCES</b><br>2.1) 2.1 Pure substance<br>2.2) 2.2 Phase changes, property diagram<br>2.3) 2.3 Law of Corresponding state, critical properties<br>2.4) 2.4 Steam table<br>2.5) 2.5 Ideal gas, real gas<br>2.6) 2.6 Equation of State   |  |
| <b>3. 3. ENERGY TRANSFER BY HEAT WORK AND MASS</b><br>3.1) 3.1 Heat transfer<br>3.2) 3.2 Energy transfer by work<br>3.3) 3.3 Mechanical form of work  |  |
| <b>4. 4. FIRST LAW OF THERMODYNAMICS</b><br>4.1) 4.1 First law: open and closed system<br>4.2) 4.2 Reversible isothermal and adiabatic expansion of ideal gas<br>4.3) 4.3 Enthalpy of reaction<br>4.4) 4.4 Effects of temperature on enthalpy change  |  |
| <b>5. 5. SECOND AND THIRD LAW OF THERMODYNAMICS</b><br>5.1) 5.1 Statements of second law, entropy<br>5.2) 5.2 Statistical interpretation of entropy<br>5.3) 5.3 Heat engine, heap pump and refrigerator : Carnot cycle and thermodynamic efficiency<br>5.4) 5.4 Entropy<br>5.5) 5.5 Entropy change in pure substance<br>5.6) 5.6 Entropy calculations for physical and chemical processes<br>5.7) 5.7 Third law of thermodynamics |  |

**6. 6. FREE ENERGY AND CHEMICAL POTENTIAL**

- 6.1) 6.1 Free energy function and properties
- 6.2) 6.2 Free energy and spontaneity
- 6.3) 6.3 Gibb's free energy and its temperature dependence
- 6.4) 6.4 Chemical equilibrium calculations

**7. Assignments**

- 7.1) Topic should be related to the application of thermodynamics in our daily life.

| Assessment Breakdown  | %      |
|-----------------------|--------|
| Continuous Assessment | 70.00% |
| Final Assessment      | 30.00% |

| Details of Continuous Assessment | Assessment Type | Assessment Description                                      | % of Total Mark | CLO  |
|----------------------------------|-----------------|---|-----------------|------|
|                                  | Assignment      | One or two assignment related to thermodynamic applications | 30%             | CLO3 |
|                                  | Online Quiz     | Average of 4 quizzes  | 10%             | CLO1 |
|                                  | Test            | Average of 2 tests  | 30%             | CLO2 |

| Reading List | Recommended Text   |
|--------------|--|
|              | <ul style="list-style-type: none"> <li>• Michael Boles, Yunus Cengel 2014, <i>Thermodynamics: An Engineering Approach</i>, 8th Edition Ed., McGraw-Hill Education [ISBN: 0073398179]</li> <li>• J. Richard Elliott, Carl T. Lira 2012, <i>Introductory Chemical Engineering Thermodynamics</i>, 6th Edition Ed., Prentice Hall [ISBN: 0136068545]</li> <li>• Gordon Hargreaves, George Socrates, <i>Elementary Chemical Thermodynamics</i> [ISBN: 0408704314]</li> </ul> |

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|---------------------------|---|
| <b>Article/Paper List</b> | This Course does not have any article/paper resources |
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| <b>Other References</b> | This Course does not have any other resources |
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