UNIVERSITI TEKNOLOGI MARA

CMT252: CHEMICAL THERMODYNAMICS

Course Name (English)	CHEMICAL THERMODYNAMICS APPROVED
Course Code	CMT252
MQF Credit	3
Course Description	This course covers the basic concepts of chemical thermodynamics and includes useful applications of thermodynamics concepts, particularly energy calculations in a reaction. The topics include an introduction to thermodynamics, properties of pure substances, energy analysis of closed system first law of thermodynamics and its application in closed and open systems, enthalpy, entropy, second law of thermodynamics, the Gibbs function and third law of thermodynamics.
Transferable Skills	Able to apply an ideas to solve problem and contribute positively in a team with ethical frameworks.
Teaching Methodologies	Lectures
CLO	CLO1 Explain the basic principles in chemical thermodynamics. CLO2 Relate the chemical thermodynamics laws to produce systematic solution in thermodynamics problems. CLO3 Demonstrate competency in information management skills in areas of thermodynamics for specific applications.
Pre-Requisite Courses	No course recommendations

Topics
1. Introduction to Thermodynamics 1.1) Usefulness of thermodynamics to engineer and scientist. 1.2) Dimension and units-SI and English Units 1.3) Terms and definitions in Thermodynamics 1.4) Pressure, volume and temperature 1.5) Intensive vs. extensive properties 1.6) Systems - closed and open system 1.7) System states - isothermal, isobaric, isochoric and adiabatic 1.8) Process states - reversible and irreversible process 1.9) Thermodynamics equilibrium
2. Properties of Pure Substances 2.1) Pure substance and phase equilibrium 2.2) Phase changes of pure substances 2.3) Property diagrams for phase change process – P-v and T- v diagram 2.4) Steam table 2.5) Interpolation and quality calculation 2.6) The ideal gas equation of state 2.7) Critical properties 2.8) Introduction to other equation of states - Virial, Benedict-Webb-Rubin and Van der Waals equations.
3. Energy Analysis of Closed System 3.1) Types of energy 3.2) Energy transfer by heat 3.3) Energy transfer by work 3.4) Mechanical forms of work: boundary work for various thermodynamics processes 3.5) Energy balances for closed system 3.6) Specific heats 3.7) Internal energy, enthalpy, and specific heats of ideal gas 3.8) Specific heat relations of ideal gases

3.9) Internal energy, enthalpy, and specific heats of solid and liquids 3.10) Internal energy changes 3.11) Enthalpy changes
4. First law of the Thermodynamics 4.1) Application of first law - Energy balances of closed system 4.2) Energy balances of open system 4.3) Conservation of mass principle 4.4) Flow work and the energy of a steady flow system 4.5) Energy analysis of steady flow systems 4.6) Steady flow devices energy analysis
5. Second law of thermodynamics 5.1) Statements of the second law 5.2) Applications of the second law - Calculation involve heat engines, refrigerators and heat pumps. 5.3) The Carnot cycle and thermodynamic efficiency 5.4) Entropy 5.5) Definitions and their interpretation 5.6) Entropy calculations for pure substance, solid and liquids and ideal gas 5.7) Isentropic process
6. Introduction to Third Law of Thermodynamics 6.1) Free energy and spontaneity 6.2) Hemholtz free energy or work function 6.3) Gibb's free energy and its temperature dependence 6.4) Chemical equilibrium calculations

Assessment Breakdown	%
Continuous Assessment	100.00%

Details of Continuous Assessment

Assessment Type	Assessment Description	% of Total Mark	CLO
Assignment	Group assignment	30%	CLO3
Online Quiz	Online Quiz	20%	CLO1
Test	Online Test 1	25%	CLO2
Test	Online Test 2	25%	CLO2

Reading List

Reference Book Resources

- **Yunus A. Çengel,Michael A. Boles,Mehmet Kanoglu 2020, *THERMODYNAMICS: AN ENGINEERING APPROACH, SI*, 9 Ed., Mc Graw Hill [ISBN: 9789813157873]**
- **Morhan J. M and Shapiro H. N 2004, *Fundamentals of Engineering Thermodynamics***
- **Irvang M. Klotz and Robert M. Rosenberg 2000, *Chemical Thermodynamics*, 6 Ed., , John Wiley & Sons. Inc. [ISBN:]**
- **Kyle B. G. 1999, *Chemical and Process Thermodynamics*, 3 Ed., , Prentice Hall, New Jersey, USA [ISBN:]**
- **Dykstra C. E 1997, *Physical Chemistry: A Modern Introduction*, Prentice-Hall Inc.**

Article/Paper List: This Course does not have any article/paper resources

Other References: This Course does not have any other resources