به نام خدا

طرح درس: ترمودینامیک مهندسی شیمی I

تاریخ بروز رسانی: مهرماه ۱۴۰۴

دانشکده: مهندسی شیمی، نفت و گاز

نیمسال: نیمسال دوم ۱۴۰۴-۰۱

نام درس	**فارسی:** ترمودینامیک مهندسی شیمی I	**تعداد واحد:** نظری 3	**مقطع:** کارشناسی
	انگلیسی: Chemical Engineering Thermodynamics-I	**پیشنیازها:** موازنه انرژی و مواد	
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برنامه تدریس در هفته و شماره کلاس: شنبه ۱۷-۱۵ و دوشنبه ۱۷-۱۵			

اهداف درس:

1. To understand and be able to use the first law of thermodynamics for open and closed systems, to set up energy balances for steady- and unsteady-state processes and to solve them for simple and classic cases.

2. To understand and be able to use the second law of thermodynamics, to set up entropy balances for steady- and unsteady-state processes and to solve them for simple and limiting cases to establish bounds for solutions to engineering problems.

3. To evaluate thermodynamic properties of pure substances with special emphasis on fluids. Be able to use various PVT equations-of-state and heat capacities to evaluate thermodynamic properties (U, H, P, V, T, etc.)

4. To be able to calculate heat transfer rates associated with processes involving phase changes and reactions. To be able to calculate standard heats of reaction.

5. To understand the interrelationships between different thermodynamic properties and become familiar with the calculus that establishes these interrelationships.

6. To be able to use various sources of thermodynamic data and properties, including graphs and tables. To use graphs of thermodynamic properties to develop an intuition for the variation of these properties during various processes.

7. To apply the laws of thermodynamics and various methods of evaluating state properties to equipment commonly encountered in chemical engineering processes, such as turbines, pumps, engines, and refrigeration units.

امکانات آموزشی مورد نیاز: کلاس مجهز به امکانات سمعی و بصری

نحوه ارزشیابی	ارزشیابی مستمر	میان ترم	پایان ترم
نمره	۳	۵	۱۲

منابع و مآخذ	
Introduction to Chemical Engineering Thermodynamics, J.M. Smith, H.C. Van Ness and M.M. Abbott, 2018, 8th edition, McGraw-Hill.	

بودجه بندی درس

فصل کتاب	مبحث	هفته آموزشی
Chapter 1: Introduction	• Review of basic concepts from physics • Force • Work and power • Pressure • Temperature • Energy, potential and kinetic energy Heat	**1**
Chapter 2: The First Law of Thermodynamics	• Internal energy • First Law of Thermodynamics: energy balances • First Law of Thermodynamics for closed systems • State functions and path integrals • Equilibrium • Phase rule • PV work • Reversible and irreversible processes • Process calculations for ideal gases • Enthalpy • Heat capacity • First Law (energy balance) for open systems	**2-4**
Chapter 3: Volumetric properties of fluids	• PVT behaviors of pure substances • PVT equations-of-state (EOS) • Ideal gas EOS • Virial EOS • Van der Waals EOS • General cubic EOS • Redlich-Kwong EOS • How to solve cubic EOS • Theory of Corresponding States • Generalized PVT correlations for gases • Generalized PVT correlations for liquids	**5-7**
Chapter 4: Heat Effects	• Sensible heat • Latent heat • Heat of reaction • Combustion • Heat effects of chemical reactions	**8-9**
Chapter 5: The Second and Third Laws of Thermodynamics	• Definition of entropy • Second Law of Thermodynamics • Consequences of the Second Law: limits on efficiency	**10-12**

	• Heat engines • Carnot cycle and Carnot engine • Entropy changes for an ideal gas • Entropy balance • Third Law of Thermodynamics	
Chapter 6: Thermodynamic Properties of Fluids	• Property relations for homogeneous phases • Maxwell relations and other thermodynamic identities • How to calculate thermodynamic properties from PVT EOS and heat capacity data • Residual properties • Two-phase systems • Thermodynamic property diagrams • Tables of thermodynamic properties	**13-14**
Chapter 7: Applications of Thermodynamics to Flow Processes	• Turbines • Compressors • Pumps • Flow through ducts and nozzles	**15**
Chapter 8: Production of Power from Heat	• Steam power plant and the Rankine cycle • Gas turbines • Internal combustion engines • Diesel engines • Jet engines	**16**