

| Department of Chemical Engineering | | | |
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| Thermodynamics (64233) | | | |
| Total Credits | | 3 | |
| major compulsory | | | |
| Prerequisites | | P1 : General Chemistry I (23101) | |
| Course Contents | | | |
| Fundamental concepts; First & second laws; Analysis of open and closed systems; Properties & states of substances; Work & energy; Processes and power cycles; and entropy | | | |
| Intended Learning Outcomes (ILO's) | | Student Outcomes (SO's) | Contribution |
| 1 | Analyze energy transfer and transformation in systems using fundamental concepts of properties of materials, work, heat, internal energy, entropy, equilibrium, and relations derived from the First and Second Laws of Thermodynamics | A | 25 % |
| 2 | Use the methods to measure thermodynamic properties and estimate values for properties using property tables and relations | A | 25 % |
| 3 | Carry out thermodynamic analysis of engineering devices and systems such as piston-cylinders, compressors, turbines, pumps, heat exchangers, heat engine cycles, and refrigeration cycles using energy, materials, and entropy relations. | E | 50 % |
| Textbook and/ or References | | | |
| Textbook (Online Resources) Cengel and Boles THERMODYNAMICS, an engineering approach, 7th edition, 2011 McGraw-Hill Reference Shapiro, H., Fundamentals of Engineering Thermodynamics, 7th Edition, 2011. John Wiley and Sons | | | |
| Assessment Criteria | | Percent (%) | |
| First Exam | | 20 % | |
| Second Exam | | 20 % | |
| Quizzes | | 10 % | |
| Homeworks | | 10 % | |
| Final Exam | | 40 % | |
| Course Plan | | | |
| Week | Topic | | |
| 1-2 | BASIC CONCEPTS OF THERMODYNAMICS Thermodynamics and Energy A Note on Dimensions and Units Closed and Opens Systems Forms of Energy Properties of a System State and Equilibrium Processes and Cycles The State Postulate Pressure Temperature and the Zeroth Law of Thermodynamics | | |
| 3-4 | PROPERTIES OF PURE SUBSTANCE Pure Substance Phases of a Pure Substance Phase Change Processes of Pure Substances Property Diagrams for Phase Change Processes Property Tables The Ideal-Gas Equation of State Compressibility Factor Other Equations of State | | |
| 5-6 | THE FIRST LAW OF THERMODYNAMICS: CLOSED SYSTEMS Introduction to the First Law of Thermodynamics Heat Transfer Work Mechanical Forms of Work Specific Heats Internal Energy, Enthalpy, and Specific Heats of ideal gases Internal Energy, Enthalpy, and Specific Heats of solids and liquids | | |
| 7-9 | THE FIRST LAW OF THERMODYNAMICS: CONTROL VOLUMES Thermodynamic | | |

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| | Analysis of Control Volumes The Steady-Flow Process Some Steady-Flow Engineering Devices The Steady-Flow Process Some Steady-Flow Engineering Devices |
| 10-13 | THE SECOND LAW OF THERMODYNAMICS Introduction to the Second Law of Thermodynamics Thermal-Energy Reservoirs Heat Engines Refrigerators and Heat Pumps Perpetual-Motion Machines Reversible and Irreversible Processes The Carnot Cycle The Carnot Principles The Thermodynamic Temperature Scale The Carnot Heat Engine The Carnot Refrigerator and Heat Pump |
| 14-15 | Entropy Internally Reversible Isothermal Heat Transfer Processes The Increase of Entropy Principle Isentropic Processes The T ds Relations Entropy Change of Liquids and Solids and Ideal Gases Reversible Steady-Flow Work Isentropic Efficiencies of Steady-Flow Devices Entropy Balance |