

國立臺北大學自然資源與環境管理研究所
102 學年度第一學期 『環境工程科學概論』 (在職專班)

課程講義(五)：物質與能量平衡
Conservations of Material and Energy

- INTRODUCTION – UNIFYING THEORIES
 - Conservation of Matter => Chemical Reactions
 - Conservation of Energy => Laws of Thermodynamics
 - Conservation of Matter and Energy => The Theory of Relativity
- MATERIAL BALANCE
 - Control Volume, Control Mass, and System
 - Steady State vs. Transit or Dynamic => Rate of Change
 - (Accumulation Rate) = (Input Rate) – (Output Rate) ± (Transformation Rate)
 - Steady-State Conservative Systems
 - Batch Systems with Non-conservative Pollutants
 - Steady-State Systems with Non-conservative Pollutants
- ENERGY BALANCE
 - First Law of Thermodynamics
 - ⇒ Thermal Unit of Energy
 - ⇒ Specific Heat Capacity
 - ⇒ Latent Heat, Overheated Stream, Subcritical and Supercritical
 - ⇒ Pressurized Water Reactors (vs. Boiling Water Reactors)
 - Second Law of Thermodynamics
 - ⇒ Energy: Heat, Kinetic Energy, Potential, Electricity, etc.
 - ⇒ Work, Unusable Energy, Entropy and Disorder/Randomness
 - ⇒ Thermal Efficiency: Carnot Engine
 - ⇒ Thermal Power Plants: Coal, Oil and Natural Gas; Steam Generator and Internal combustion; Combined Cycle and IGCC
 - Conductive and Convective Heat Transfer
 - Radiant Heat Transfer
 - ⇒ Solar Energy: Heat vs. Photovoltaic
 - ⇒ Electromagnetic Spectrum
 - ⇒ Wavelength vs. Frequency
 - Heat Engine vs. Heat Pump
- UNIT OF MEASUREMENT
 - Basic Units: Length, Mass, Time, and Temperature
 - International System of Units (SI) vs. Imperial System (U.S. customary units)
 - Extended Units: Concentration, Dose, ppm(m), ppb(v), Energy, “Equivalent”

