國立臺北大學自然資源與環境管理研究所
100 學年度第一學期『環境工程科學概論』
課程講義(六)：成長模式－環境數學概要

- INTRODUCTION
  - □ Description, Modeling, and Prediction
  - □ Quantity, Measurement, Scalar => "Number+Unit" => Dimensionless Analysis
  - □ Uncertainty, What-If, Simulation, and Scenario Analysis
  - □ Conceptual, Analytical vs. Numerical Models
    - ⇒ Concept Mapping (Mind Map)
    - ⇒ System Dynamics and System Thinking
    - ⇒ Statistical Models (?)

- REVIEW OF CALCULUS
  - □ Rate of Change => Differential Equation
    - ⇒ Increase (Ascending Tendency): Growth => Positive Rate of Change
    - ⇒ Decrease (Descending Tendency): Degradation => Negative Rate of Change
  - □ Ordinary Differential Equation (ODE) and Partial Differential Equation (PDE)
  - □ Degree and Order of an Ordinary Differential Equation

- EXPONENTIAL GROWTH
  - □ Continuous Compounding and First Order Degradation
  - □ Doubling Time and Half-Life
  - □ Disaggregated Growth Rates => IPAT and Kaya Identity
  - □ Exponential Resource Production Rates
  - □ Symmetrical Production Curve => Normal (Gaussian) Distribution
  - □ The Hubbert Hypothesis => Hubbert Peak of Oil Production

- POPULATION GROWTH
  - □ Logistic Growth and Maximum Sustainable Yield
    - ⇒ Carrying Capacity
    - ⇒ Maximum Sustainable Yield
  - □ Indices of Demography
    - ⇒ Crude birth rate
    - ⇒ Fertility rate
    - ⇒ Crude death rate
  - □ Age Structure and Population Momentum
  - □ Human Population Projection

- NUCLEAR CHEMISTRY
  - □ Isotopes, Radiations, and Measurement
  - □ Atom Decay and Half Life
  - □ Nuclear Fission
    - ⇒ Relativity Theory: $E = mc^2$
    - ⇒ Chain Reactions
  - □ Nuclear Power Generation
    - ⇒ Nuclear Reactors
    - ⇒ Treatment and Disposal of Nuclear (Spent) Fuels and Radioactive Wastes
    - ⇒ 台灣現有核能電廠裝置容量表

廠 別	核能一廠	核能二廠	核能三廠
位 置	台北縣石門鄉	台北縣萬里鄉	屏東縣恆春鎮
商業運轉日 期	#1: 67 年 12 月 #2: 68 年 7 月	#1: 70 年 12 月 #2: 72 年 3 月	#1: 73 年 7 月 #2: 74 年 5 月
裝置容量	636 千瓩×2	985 千瓩×2	951 千瓩×2
反應器	輕水反應器（沸水式）	輕水反應器（沸水式）	輕水反應器（壓水式）

  - □ 第四核能發電廠（現定名為『龍門核能發電廠』）
    - ⇒ 進步型沸水式反應爐；兩部容量各為 1,350,000 瓩之發電機組。
    - ⇒ 行政院通過台電核四建設案：1980.5；動工日期：1999.03.17 （經 3 次延宕）
    - ⇒ 原定裝填燃料棒日期：2010.12；暫定設定裝填燃料棒日期：2012.04
    - ⇒ 原定商轉日期：2011.12；暫定設定商轉日期：2013.04
    - ⇒ 原本預算：約 1800 億；迄今追加累計預算：約 2700 億
    - ⇒ 台電核能資訊專區 http://www.taipower.com.tw/left_bar/nuclear4/index.html
    - ⇒ 財團法人核能資訊中心 http://www.nicenter.org.tw/index.php

- WATER CHEMISTRY
  - □ Physical Properties of Water
  - □ State of Solution Impurities
    - ⇒ Distillation, Precipitation, Adsorption, and Liquid Extraction => Suspensions
  - □ Concentration Units in Aqueous Solution s or Suspensions
    - ⇒ ppm vs. mg/L; Normality and Equivalent Weight
  - □ Buffers => Buffering Capacity
  - □ Transport and Fate of Water Pollutants

- ATMOSPHERIC CHEMISTRY
  - □ Compressible Fluids vs. Incompressible Fluids
  - □ Ideal Gas Law and Idea Gas Constant
  - □ Dalton's Law of Partial Pressures and Henry Constant
  - □ Photochemical Reactions