Department of Civil and Environmental Engineering
Stanford University
CEE 70 – Environmental Science and Technology (Engr 90 Cross Listed)

Time and Place: Monday through Thursday 10:30 to 11:20, Y2E2 111

Instructor: Royal Kopperud
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Teaching Assistants: James Winter, Annie Yu

Office Hours: Y2E2, time and location to be announced


Homework: 20% of Final Grade Homework sets handed out approximately weekly, due 1 week later. Homework is due before class begins and may be submitted in class or in the drop box at Y2E2 (Yellow Atrium Basement - Shelves).

Although you may work together in groups of 2 or 3 to develop your understanding of the homework questions, your submitted homework must be a product of your own effort and must represent your own understanding. Observe the Honor Code in preparing your homework.

Exams: 3 quizzes in class for 80% of Final Grade. 7/13/2017, 8/1/2017, and 8/17/2017. There will be no final exam.

Announcements: Canvas course site. You should be automatically added to the site. Be sure to enable immediate notifications for announcements.
Topic Outline (Readings from IEES 3rd Ed.) Lecture Numbers are at the right.

Mass and Energy (pp. 1 - 35)........................................................................1, 2, 3
  Ideal gas law
  Mass balances
    Steady-state
    First-order decay
  Energy balance
  Heat capacity and heat of vaporization
  Energy efficiency

Chemistry (pp. 47-70).........................................................................................4
  Stoichiometry
  Reaction enthalpy
  Equilibrium constants and pH
  Read and understand alpha-diagrams

Population Growth (Ch 3 especially pp. 87-94, 106-120).................................5
  Exponential growth
  Half life and doubling time
  Human population dynamics

Risk Assessment (Ch 4 especially pp. 145-157)..................................................6, 7
  Potency Factor or Oral Slope Factor
  Drinking water unit risk / Inhalation unit risk
  Drinking water equivalent level at $10^4$, $10^5$, and $10^6$ risk
  Inhalation unit risk
  RfD, hazard quotient, and Hazard Index

Water Pollution (Ch 5, especially pp. 199-226, 229-240).................................8, 9
  Biochemical Oxygen Demand
  ThOD, BOD$_5$, CBOD, NBOD
  Rate constants and temperature dependence
  Streeter-Phelps oxygen sag curve

Lakes (pp. 219-226).........................................................................................10
  Algae and limiting nutrients
  Oligotrophic, mesotrophic, and eutrophic lakes
  Thermal stratification

Groundwater (pp. 229-244) ..............................................................................11
  Porosity
  Hydraulic gradient
  Darcy's Law, Darcy velocity
  Average linear velocity and retardation

Water Quality (pp 289-295, 299-302, 314-332)..................................................12, 14
  Safe Drinking Water Act
  Maximum Contaminant Level (MCL) and MCL Goal (MCLG)
  Treatment Technique (TT)
  Secondary Standards
  Basic wastewater unit operations
Settling and Stoke's Law
Settling basins
Combined and separate sewer systems

Reverse Osmosis (pp. 314-315) ................................................................. 13

Air Pollution (Skim pp. 367-384; 389-393; skim 394-426; 426-428; 437-438; 438-450; 450-458; 483-end of ch.7) ................................................................. 15 through 19

Criteria Pollutants
Air Quality Index (AQI)
Carbon monoxide
Stokes Law
Atmospheric stability
Ozone
Automobile pollution
Gaussian dispersion
Box model - steady state and transient solutions

Global atmospheric change (Skim pp. 502-512; 512-536; skim 536-545; 545-551; 554-558; 574-587) ................................................................................................. 20, 21

Energy balance and radiation
IR window
Albedo
Climate sensitivity
Global Warming Potential (GWP)
Stabilization wedges
Chlorine and stratospheric ozone