GEOL 420 Principles of Environmental Geology, (3 Credits)

General Course Description: This course explores the nature, dynamics and human interactions with near-surface geologic environments including aquifers, watersheds, coastlines and wetlands. We will also explore how specific techniques, including geophysical and geochemical techniques, field mapping, geographical information systems and remote sensing can be used to monitor human-geosphere interactions as well as be used to develop solutions or management plans for environmental problems.

Instructor:	Dr. Herbert [herbert@geo.tamu.edu]
Lecture:	MW 10:20AM-11:10AM HALB 308
Prerequisites:	GEOL 101 Physical Geology or GEOG 203 Planet Earth.
Web Site	http://geol420.pbworks.com/
Textbooks:	Associated readings will be assigned and generally available online.
Exams	2 exams: a midterm and a cumulative final. Weekly assignments covering problem sets, projects, short essays, and/or presentations. Midterm: Wednesday, February 26th, in class. Final Exam: Tuesday, May 11, 8-10 a.m., HALB 308
Grading:	Exams/projects are each 50% of your grade each. [A:91-100%; B:81-90%; C:71-80%; D:61-70%; F:<61%]. Make up exams are one week after missed exams. Makeup exams are essay tests.
ADA Statement	The American with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities in Room 126 of the Koldus Building. The phone number is 845-1637.
Plagiarism:	The handouts used in this course are copyrighted. By "handouts" I mean all materials generated for this class, which include but are not limited to syllabi, quizzes, exams, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts, unless I expressly give permission. As commonly defined, plagiarism consists of passing off as one's own the ideas, words, writings, etc., which belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you have permission of that person. Plagiarism is one of the worst academic sins, for the plagiarist destroys the trust among colleagues without which research cannot be safely communicated. If you have any further questions concerning plagiarism, please consult the latest issue of the *Texas A&M University Student Rules*, under the section "Scholastic Dishonesty".

Section One: The Nature of the Geologic Environment

1. **Introduction**
   - The scope of environmental geology
   - Anthropogenic interactions with the geologic systems
   - Human population and the sustainability of Earth systems
   - Complex systems and environmental problem solving strategies
     - Framework: boundaries, components, inputs/outputs, and interactions/transformations
     - Residence time
     - Cycling & transformations
     - Interactions, feedback mechanisms, and thresholds
     - Equilibrium & dynamics
     - Entropy and pattern formation
     - Modeling & representations
2. **Process Geomorphology and the Near-surface Geologic Environment**
   - Process geomorphology
   - Landforms and geomorphic processes
   - Near-surface geologic environments
   - Soil pedalogy and classification
   - Case study: Texas soil resources and land use
3. **Hydrology and Water Resources**
   - Components of the hydrologic cycle: reservoirs and transfer processes
   - Surface water hydrology: box models
   - Hydrogeology of subsurface environments
   - Case studies: Pacific NW water resources
4. **Geologic Control of Water Quality**
   - The hydrologic cycle, residence times and rock-water ratios
   - Geochemical reactions that control natural water quality
   - Case studies: Acid mine drainage at Globe, AZ

Section Two: Perturbed Geologic Environments

5. **Contaminants in Geologic Environments**
   - Sources and properties of anthropogenic contaminants in geologic environments:
   - Major biogeohydrochemical processes affecting contaminant fate in geologic environments
   - Ecotoxicology and risk assessment
   - Case study: South Texas arsenic
6. **Contaminant Hydrogeology**
   - Solute transport in saturated systems
   - Hydrologic characterization of subsurface systems
   - Sampling contaminanted soils and groundwaters
   - In-situ remediation of contaminated sites and waste disposal
   - Case Study: Natural Attenuation of Crude Oil, Bemijdi, MN.
7. **Watersheds and Surface Water Quality**
   - Climatic, tectonic, and human control on physiographic features of watersheds
   - Watershed Hydrology: Connectivity
   - Biogeochemical cycling in the terrestrial biospheres and watershed
   - Nonpoint-source pollution and surface water hydrology
   - Case History: Nonpoint-source pollution in the South Platte River Watershed