CE 311A: Environmental Quality and Pollution

Instructor (theory): Abhas Singh

Schedule: MF 8:00 – 8:50; W 16:00-16:50

Venue: L2

Text Books:

Environmental Engineering Science. First Edition (2001).

By: William W. Nazaroff and Lisa Alvarez-Cohen. John Wiley and Sons Inc.

Chemistry for Environmental Engineering. Fourth Edition (1994).

By: Clair N. Sawyer, Perry L. McCarty and Parkins, G. F.

I recommend that you purchase the text book (Indian edition available), though several copies of these books are available in the central library.

Other relevant material will be circulated through e-mail or posted on Brihaspati from time to time.

Concept of Sustainable Habitat



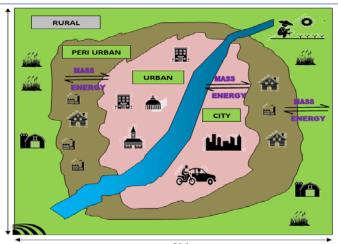
 To ensure availability of breathable clean air, _____ potable water, affordable, safe housing and energy-efficient, low-emission transport systems

Challenges:-

- Sustainable water, land-use and mitigation strategies to be integrated in habitat planning
- Using waste and recycled materials for construction of roads and buildings
- Highly contaminated zones requiring efficient remediation strategies urgently
- Safety of living as well as non-living assets, in the wake of natural and man-made disasters

Why us?

- We are technically, culturally and intellectually capable of solving these problems
- For too long we have neglected environment in the name of development; best to tackle ourselves



Targeted Habitat (up) and Associated Aquifers (below)



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Energy-efficient Smart Urban Infrastructure

- Green construction and road material
- Instrumented traffic behavior facility
- Geo-centrifuge test facility
- Geospatial mapping of habitat

Infrastructure and pollution

River, Groundwater and Impact of Glacier Melting

Protocols for river health

Water

resources and

their health

- Sustainable surface and groundwater management
- Improving irrigation efficiency
- Impacts of glacier melting

Disaster and infrastructure

Environmental quality

Pollution Prevention, Mitigation and Remediation

- Clean air for human habitat
- Waste reuse, recycling and landfill development
- Potable water and clean soil

Earth's tipping point and natural disasters

Future Earth

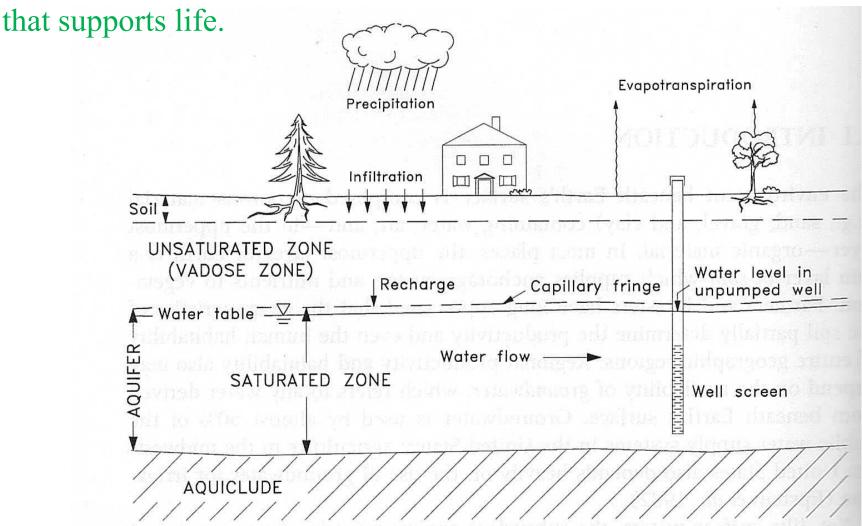
- Understanding the drivers and impacts of earth's dynamic processes
- Monitoring of Critical Zone and Tipping point
- Characterization of natural hazards and resilience of structural systems
- GIS-based flood risk maps

Disasterimpacted pollution

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The Biosphere

A thin layer (10 km upwards and downwards) from the earth's surface



Source: *Chemical Fate and Transport in the Environment*, 2nd Ed., Hemond, H.F. and Fechner-Levy, E.J. (2000).

Three abiotic components of biosphere are:

- 1) Atmosphere 2) **Hydrosphere** 3) Lithosphere

Two major components of **Hydrosphere**:

- 1) Fresh Water 2) Saline water

We are mainly concerned with Fresh Water, i.e.,

- 1) Surface water i.e., water found in rivers and lakes
- 2) Groundwater i.e., water found in the sub-surface

Human civilization is dependent on the quantity and quality of available fresh water.

In this course, focus on the quality of fresh water.

Contaminant vs Pollutant

Contaminants: Impurities in fresh water, either dissolved or suspended

- Naturally available fresh water is always impure, i.e., it contains contaminants.
- Presence of contaminants is not harmful to the health of human beings and other organisms.

Pollutants: Contaminants present at concentrations high enough to adversely impact health of human beings and other organisms

Movement of Contaminants to the Subsurface



I Quality and Pollution

Class Problem

On a piece of paper provided to you, please answer the following question. Write your name and roll number before submitting the sheet today.

- 1 g of table salt (NaCl) is dissolved in water to make 1 L of solution. For Na⁺ in solution, determine:
- a) Mass fraction
- b) Mass concentration
- c) Molarity
- d) Normality