

INTRODUCTION

You all have studied courses in the previous semesters on

- Surface Water Hydrology
- Advanced Fluid Mechanics

Now you don't require introduction on hydrology.

We have seen that water on earth exist in

- * Atmospheric system
- * Surface Water System
- * Subsurface Water System

This particular course CE 556 deals with the scientific explanation on "Subsurface Water".

⇒ The subsurface zone of earth is conceptualised as porous media.

Porous media applications come into application wide branch of science and engineering.

- ↳ Ground water hydrology
- ↳ Oil reservoir engineering
- ↳ Soil science and soil mechanics
- ↳ Chemical engineering,
- ↳ Agricultural engineering, etc.

(2)

We will be mostly dealing with ground water hydrology and unsaturated zone hydrology, although the theories explained here are very much applicable to other porous media.

⇒ This course has 42 lectures as given in the schedule print-outs.

⇒ The syllabus is given in the Civil Engineering website.

We will deal with

- * Continuum approach in porous media
- * Darcy's law,
- * Flow through saturated and unsaturated porous media
- * Well hydraulics
- * Solute transport in porous media
- * Application of numerical models
- * If time permits may go through some groundwater optimisation problems.

Basic Terms & Definitions

As this is a master's program, most of us have some basic information on terms used in subsurface hydrology.

- (i) Aquifer → The geologic formation that contains water and also allows the flow of water through it.
- (ii) Aquitard → Semi-pervious geologic formation that may transmit water at small rates. (Also leads to formation of leaky aquifers)
- (iii) Aquiclude → May contain water in the geologic formation, however, it may not transmit them.
- (iv) Aquituge → Fully impervious geologic formations

Vertical Profile of Moiss

Q: What is meant by porous media?

→ A soil, or rock, or a filter, etc consists of — solid matter and void spaces (like pores, fissures, interstices, etc.).

→ It is in these pores water/air are stored or through them transmitted.

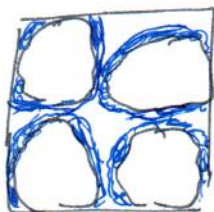
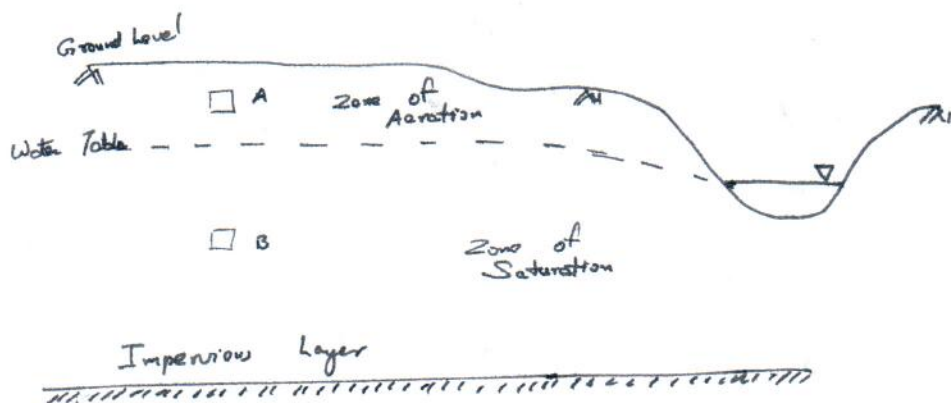
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Any ^{solid} formation that have inter connected voids or interstices or pores are termed as porous media.

→ If you go through geologic text books you may come across

- ↳ original interstices
- ↳ secondary interstices.

Vertical profile of moisture distribution in porous media



Enlarge view of A



This portion is from zone of aeration.

Pores contain both air and water.

This portion is from zone of saturation.
All the pores are filled with water.

(5)

There is a dotted line. It is called Water Table.
At the water table the pressure is atmospheric.

Q: Why the pressure is atmospheric?

S: Look at the water surface in the river
cross section. The pressure on water surface
is atmospheric. The water table of zone of
saturation is connected to water surface.

(In subsequent lectures we will discuss more scientifically
about this.)

In surface water hydrology you have already studied the
phenomenon on infiltration.

⇒ The infiltrated water percolates down to form ground
water bodies in the subsurface.

In Zone of Aeration (i.e. the region from ground level
to the water table) there are three sub-zones

↳ Soil water zone

↳ Intermediate or vadose zone

↳ Capillary zone.

The term aquifers and other ground water formations
are typically in zone of saturation.

⑥

ASSIGNMENT NO: 1

(Due Date 10-01-2014)

From your previous experiences as well as referring text books, literatures, and internet give descriptions (along with figures) on

- * Aquifers
- * Aquitards
- * Aquicludes
- * Aquifuges
- * Hydraulic Conductivity
- * Confined Aquifers
- * Unconfined Aquifers
- * Artesian Aquifers

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