

CIV E 681 – SEEPAGE AND DRAINAGE
Fall 2014
Department of Civil & Environmental Engineering
University of Alberta

Instructor:	Dr. L. Deng NREF 3-143, ldeng@ualberta.ca
Lectures:	TU TR 11:00 – 12:20 NREF 2-020
Office hour:	By appointment or walk in
Laboratory:	Refer to emails from lab coordinator
Textbook:	There is no single recommended text
References:	Cedergren (1989) Seepage, Drainage, and Flow Nets Harr (1962) Groundwater and Seepage Supplementary References Lecture notes
Grading:	50% term work 5 Assignments. 25% 10 Reading assignments. 15% 4 Graduate laboratories (2 lab reports). 10% 50% Final exam

Course Outline (subject to changes)

1) Introduction

Importance of groundwater flow and seepage control in geotechnical engineering

2) Elements of Hydrogeology

Regional groundwater flow

3) Fundamentals of Groundwater Flow (GWF)

Darcy's law and validity of Darcy's Law

Permeability and its determination: Lab and field methods

Piezometers: Types, response time, time lag

4) 2D GWF Equations and Solution methods to 2D GWF

Governing equations for saturated and unsaturated:

Equations for steady-state GWF

Equations for transient GWF

Solution methods to 2D Groundwater Flow:

Flow nets, Anisotropic soil and flow net transformation

Method of Fragments

Finite different method

Introduction to FEM procedures

5) Water Pressure and Seepage failure

Hydrostatic pressure
Seepage pressure (effect of flow on earth pressure)
Piping and bulk heave

6) Well Hydraulics

Steady state flow (Dupuit-Forchheimer) into slot and well w & w/o infiltration
Reach of wells (Sichardt, Theis) and optimum flow
Multiple well systems
Methods for dewatering excavations

7) Seepage Control in Dams:

3 main control methods: filters, drainage and seepage reduction
Dam cross-sections for seepage control
Filters: Filter criteria and dimensioning filters, graded filters
Geotextiles for drainage
Seepage reduction: cores, partial cutoffs, complete cutoffs, impervious blankets, efficiency of cutoffs

8) Flow through Rock:

Permeability of rock and discontinuities
Flow through discontinuities and jointed rock
Special considerations for flow through rock (anisotropy, stress dependence)

9) Groundwater flow and contamination:

Groundwater quality
Sources of contamination
Mechanism for migration in GW
Soil chemical processes which alter contaminates
Equations for solute transport in GW

READING ASSIGNMENTS (RAS)

Read papers and hand in: (1) a summary of the reading assignment and (2) definitions of selected geoenvironmental terms from the paper, before the due date.

A summary must be typed on letter-size paper with 1 in margin using 11 pt type; 1 or 2 pages. Papers and definition sheets are downloaded from eclass

<https://eclass.srv.ualberta.ca/portal/> .

RAS 1: SEPTEMBER 19, 2014

Hodge, R.A.L., and Freeze, R.A. 1977 Groundwater Flow Systems and Slope Stability, Canadian Geotechnical Journal, 14:466-476.

RAS 2: SEPTEMBER 22, 2014

Dyck, J.H., et al. 1974 "Application of Geophysical Logging to Groundwater Studies in Southeastern Saskatchewan", Canadian Journal of Earth Sciences, 9: 78 94.

RAS 3: OCTOBER 3, 2014 (REVIEW)

Lambe and Whitman - Soil Mechanics, Chapter 17: "One dimensional Fluid Flow".

RAS 4: OCTOBER 10, 2014 (REVIEW)

Lambe and Whitman - Soil Mechanics, Chapter 18: "Two dimensional Fluid Flow".

RAS 5: OCTOBER 17, 2014 (PERMEABILITY TEST)

Kalin, M. 1977 "Hydraulic Piping - Theoretical and Experimental Findings", (No need to concentrate on mathematics), Canadian Geotechnical Journal, 14:107 124.

RAS 6: OCTOBER 24, 2014(REVIEW)

Lambe and Whitman - Soil Mechanics, Chapter 19: "Soil Permeability and Filter Requirements".

RAS 7: OCTOBER 31, 2014

Leonards, G.A. - Foundation Engineering, Chapter on Dewatering, particularly p. 310 347.

RAS 8: NOVEMBER 7, 2014 (MODEL DAM)

Casagrande, A. 1940 "Seepage through Dams", Boston Soc. of Civil Eng.,1940.

RAS 9: NOVEMBER 14, 2014

Kenney, T.C. et al. 1976 "Horizontal Drains in Homogeneous Slopes", 29th Canadian Geotechnical Conference on Slope Stability, p. VI-1 to VI-15.

RAS 10: NOVEMBER 21, 2014

Ambraseys, N.N. 1963 "Cut off Efficiency of Grout Curtains and Slurry Trenches", Symposium, London, Butterworths (Brit. Nat. Soc. of ISSMFE).