CE 648 - Flow Through Soils Spring 2018

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| **Text:** | Cedergren, H.R. Seepage, Drainage and Flow Nets, Latest Edition, John Wiley, ISBN: 0-471-18053-X |
| **Suggested Text:** | Jury, Gardner and Gardner, Soil Physics, Latest, John Wiley |
| **Instructor:** | Dr. Jay N. Meegoda, P.E., Room 221 Colton Hall, Phone, 973-596-2464, Fax: 973-596-5790, meegoda@njit.edu , office hours: Wed. 3:00-5:00 PM and M-F 10-4 by appointment |

***Prerequisite:*** *CE 641. However, instructor may waive this requirement for exceptional students. Explains the fundamentals of fluid flow through saturated and unsaturated soils and the use of computer programs for the solution of boundary value fluid flow problems in soils. The first two-thirds of the course are devoted to flow through saturated soils. The topics are mathematical description of flow through soils, solutions for steady state and transient state fluid flow and geotechnical applications. The last one-third is devoted to flow through unsaturated soils. Topics include steady state of transient state fluid flow and a presentation of how these concepts are applied to geo-environmental problems.*

| Week | Topic |
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| 1 | **Introduction** to Flow through Soils Darcy's Law |
| 1-2 | **Hydraulic heads and Pore Water Pressures** |
| 2 | **Hydraulic Conductivity** and Scale Issues Prediction/Estimation of Hydraulic Conductivity |
| 3-4 | **Saturated Flow**-Theory for Steady Flow and Transient Flow La Place Equation, and Boundary Conditions |
| 5-6 | **Geotechnical/Geo-environmental Applications** Flow Nets-Seepage through Dams and Foundations |
| 7 | **Mid-Term Exam** |
| 8-10 | **Geotechnical/Geo-environmental Applications** Filter design, Piping and Boiling in Earth dams Excavation, De-watering, Percolation test and On-site disposal of storm water |
| 11 | **Fluid Statics of Air-Water Systems** Two Phase Hydraulic Conductivity Relationships |
| 12 | **Unsaturated Steady Flow** -state infiltration to a fixed water-table Uniform soils, layered soils |
| 13 | **Unsaturated Transient Flow** Empirical formulae, Green-Ampt approach, Boltzmann transformation, Constant flux vs. constant potential solutions, Applications to layered soils and Macro-pore flow models |
| 14 | **Geo-environmental Applications** Landfills, and infiltrometers, estimation of hydraulic conductivities |
| 15 | **Final Exam** |

Meeting time and location: Wednesdays from 6-9PM in CKB 317 starting January 20

Grade: 25% Term Paper, 25% Home Work, 25% Mid-Term, 25% Final

Note: The NJIT Honor Code will be upheld and that any violations will be brought to the immediate attention of the Dean of Students. Also, students will be consulted by the instructor and all must agree to any modifications or deviations from the syllabus throughout the course of the semester.

Substitute Instructor (s): At a major university like NJIT, the faculty have obligations of diverse types. Some of the duties include involvement with ASCE, National Academy of Engineering, and other profession committee work, and review responsibilities for the National Science Foundation. In addition, research activities may require faculty to attend conferences, to present papers, and to participate in other activities.

The instructor will make every effort to miss as few classes as possible. If so, she will arrange guest lecturers who will enrich the course and the learning experience.

Other Comments: Students are expected to attend all classes. Those who fail to attend class regularly are inviting scholastic difficulty and may be dropped from the course for repeated unexcused absences.