Addis Ababa Institute of Technology

School of Civil and Environmental Engineering

Course Outline

Module Title: GROUNDWATER HYDRAULICS, **Course code:** CENG 6606, **ECTS:** 5

Evaluation Schemes*: Quizzes** and Mid Exam: **50%** and Final Exam: **50%**

1. **Introduction (2 week)**
   - 1.1. Definitions of aquifers
   - 1.2. Fundamental physical properties
   - 1.3. Pore space and porosity
   - 1.4. Hydraulic head
   - 1.5. Hydraulic conductivity
   - 1.6. Storage capacity
   - 1.7. Porous Vs Fractured medium
   - 1.8. Driving forces of groundwater flow
2. **Groundwater motion (3 weeks)**
   - 2.1. Darcy's law
   - 2.2. Groundwater flow equation
   - 2.3. Initial and boundary conditions
   - 2.4. Dupuit assumption
   - 2.5. Flow net analysis
   - 2.6. Approaches to groundwater flow analysis in fractured aquifers
3. **Well hydraulics (4 weeks)**
   - 3.1. Pumping well terminology
   - 3.2. Unsteady radial groundwater flow
   - 3.3. Distance-Drawdown curves
   - 3.4. Partial Penetration
   - 3.5. Recovery data
   - 3.6. Bounded aquifers
   - 3.7. Pumping test
4. **Groundwater modelling (2 weeks)**
   - 4.1. Why model groundwater?
   - 4.2. Simulating groundwater flow with software
   - 4.3. Setting up a basic groundwater flow model: tutorial with the software

*** Practice exercises will be given during the course of the semester**

**** Quizzes will be given without prior schedule notification, be attentive**

Bibliography:

1) Jacob Bear, Hydraulics of Groundwater, New York, Dover publications, 2007.
2) Jacques W. Delleur (Ed.), 2nd Edition, The Handbook of groundwater Engineering, CRC press, London.
3) Rangunath H.M., Groundwater: Hydrology, groundwater survey and pumping tests, International publishers limited, 2007 (LIBRARY).
4) Kresic Neven, Hydrogeology and groundwater modelling, CRC press, 2007 (LIBRARY).
5) John, R. Allan Freeze and Cherry, Groundwater, Prentice Hall Inc. Englewood, New J.