

Intensive Training Course on Groundwater Theory and Practice

Week 1

(Module 1) – Introduction to Groundwater Basics

(Venue : Ara room)

Date/Time	Program Description	Remarks
7.5 (Tue) 09:00-09:30	Registration	IS-Geo
7.5 (Tue)	Introduction to KIGAM and KOWACO (Foreign participants only)	
08:30-10:40	Lab Tour to KIGAM	KIGAM
11:50-12:55	Lunch	
13:00-17:45	Field Excursion to KOWACO	Dr. Yongcheol Kim
7.6 (Wed)	Session I – Groundwater Basics	
08:30-09:30	Lecture 1 : Water Cycle, Water budgets for lysimeters	Prof. Schwartz
09:40-10:40	Lecture 2 : Water budgets for small watershed, safe yield, sustainability	Prof. Schwartz
10:55-11:50	Lecture 3 : Exercise: Water budget calculation	Prof. Lee
11:50-12:55	Lunch	
13:00-14:00	Korean Language Class	
14:15-15:15	Lecture 4 : Exercise: Water budget calculation	Prof. Schwartz
15:30-16:30	Lecture 5 : Groundwater basics	Prof. Lee
16:45-17:45	Lecture 6: Groundwater basics	Prof. Schwartz
7.7 (Thu)	Session II – Theory of Groundwater Flow	
08:30-09:30	Lecture 1 : Exercise: Application of Darcy's Law	Prof. Schwartz
09:40-10:40	Lecture 2 : Flownet theory and applications	Prof. Lee
10:55-11:50	Lecture 3 : Exercise: Flownets I	Prof. Schwartz
11:50-12:55	Lunch	
13:00-14:00	Korean Language Class	
14:15-15:15	Lecture 4 : Exercise: Flownets II	Prof. Lee
15:30-16:30	Lecture 5 : Regional groundwater flow	Prof. Schwartz
16:45-17:45	Lecture 6 : Exercise: Regional groundwater flow	Prof. Schwartz
7.8 (Fri)	Session III – Surficial Manifestation of Groundwater Flow	
08:30-09:30	Lecture 1 : The Prairie Profile, groundwater – surface water interactions	Prof. Schwartz
09:40-10:40	Lecture 2 : Groundwater surface – water interactions	Prof. Lee
10:55-11:50	Lecture 3 : Exercise: Preparation of hydrogeologic cross-section	Prof. Schwartz
11:50-12:55	Lunch	
13:00-14:00	Korean Language Class	
14:15-15:15	Lecture 4 : Field Exercise I-1: Head measurement and Downhole camera	Dr. Kyucheol Ha Prof. Schwartz
15:30-16:30	Lecture 5 : Field Exercise I-2: Groundwater sample collection by bailer and pump	Dr. Yongcheol Kim Prof. Schwartz
16:45-17:45	Lecture 6 : Field Exercise I-3: Filtering and water chemistry measurements	Dr. Yongcheol Kim Prof. Schwartz
18:30-22:00	Individual tuition (optional - subject matter selected by participants) – Lecture course, exercise & discussion	Prof. Schwartz

※ The working language is Englis

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Week 2

(Module 2) – Field Investigations on Hydrogeology (7.11~7.14)

(Venue : Ara room)

Date/Time	Program Description	Remarks
7 .11 (Mon)	Registration	IS-Geo
09:00-09:30		
7 .11 (Mon)	Session I – Drilling and sampling	
08:30-09:30	Lecture 1: Common drilling and sampling methods, Geoprobe – revolution in shallow investigation	Prof. Schwartz
09:40-10:40	Lecture 2: Piezometer, Well development and hydraulic head measurements , Borehole logging, Exercise	Prof. Lee
10:55-11:50	Lecture 3 Geophysics for site investigation I	Prof Schwartz
11:50-12:55	Lunch	
13:00-14:00	Korean Language Class	
14:15-15:15	Lecture 4 Geophysics for site investigation II	Prof Schwartz
15:30-16:30	Lecture 5: Aquifers	Prof Schwartz
16:45-17:45	Lecture 6: Theis method	Prof. Lee
7 .12 (Tue)	Session II – Flow to wells I	
08:30-09:30	Lecture 1 : Exercise: Forward problem – Theis, Cooper-Jacob calculation	Prof. Schwartz
09:40-10:40	Lecture 2 : Theis type-curve	Prof. Lee
10:55-11:50	Lecture 3 : Exercise: Theis type-curve method	Prof. Schwartz
11:50-12:55	Lunch	
13:00-14:00	Korean Language Class	
14:15-15:15	Field exercise II-1: Geophysical exploration	Dr. Changryol Kim Prof. Schwartz
15:30-16:30	Field exercise II-2: Field Demonstration of Geophysical Explorations	Dr. Changryol Kim Prof. Schwartz
16:45-17:45	Field exercise II-3: Field Demonstration of Geophysical Explorations, Case study	Dr. Changryol Kim Prof. Schwartz
18:30-22:00	Individual tuition (optional - subject matter selected by participants) – Lecture course, exercise & discussion	Prof. Schwartz
7 .13 (Wed)	Session III – Flow to Wells II and Water resource assessments	
08:30-09:30	Lecture 1 : Leaky confined aquifer : Hantush-Jacob method, Exercise	Prof. Schwartz
09:40-10:40	Lecture 2 : Unconfined aquifer: Neuman method, Exercise	Prof. Lee
10:55-11:50	Lecture 3: Principles of Superposition, Exercise	Prof. Schwartz
11:50-12:55	Lunch	
13:00-14:00	Korean Language Class	
14:15-15:15	Lecture 4 : Bounded aquifer, Exercise	Prof. Schwartz
15:30-16:30	Lecture 5: Slug test: Hvorslev, Bower and Rice methods	Prof. Lee
16:45-17:45	Lecture 6: Exercise: Slug test	Prof Lee
7 .14 (Thu)	Session IV – Introduction to Groundwater Flow Modeling and Water resource assessments	
08:30-09:30	Lecture 1 : Introduction to groundwater modeling I	Prof. Schwartz
09:40-10:40	Lecture 2 : Groundwater modeling II, Case study: Otis Airforce Base I	Prof. Lee
10:55-11:50	Lecture 3: Groundwater flow model: Prickett and Lonquist I	Prof. Schwartz
11:50-12:55	Lunch	
13:00-14:00	Korean Language Class	
14:15-15:15	Lecture 4 : Groundwater flow model: Prickett and Lonquist	Prof. Schwartz
15:30-16:30	Lecture 5 : Regional Water Resource Assessment	Prof. Schwartz
16:45-17:45	Lecture 6: Exercise: water resource assessment	Prof. Lee

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Week 3

(Module 3) – Geochemistry, Isotopes, Karst hydrogeology, Age Dating (7.15 and 7.18)

(Venue : Ara room)

Date/Time	Program Description	Remarks
7.15 (Fri)	Session I – Mass in natural water	
08:30-09:30	Lecture 1 : Ions, measures of concentrations, cation / anion balance, drinking water standards	Prof. Schwartz
09:40-10:40	Lecture 2 : Plotting chemical data, exercise	Prof Schwartz
10:55-11:50	Lecture 3 : Treating water samples in the field and laboratory & Age dating: Carbon-14, Tritium, CFC	Prof. Schwarz
11:50-12:55	Lunch	
13:00-14:00	Korean Language Class	
14:15-15:15	Lab Exercise I: Basic lab measurements, CFC dating Lab Exercise II: Principle of groundwater age dating	Dr. Yoon Prof. Schwartz
15:30-16:30	Lab Exercise III: Age dating method	Dr. Yoon Prof. Schwartz
16:45-17:45	Lab Exercise IV: Sample treatment	Dr. Yoon Prof. Schwartz
18:30-22:00	Individual tuition (optional - subject matter selected by participants) – Lecture course, exercise & discussion	Prof. Schwartz
7.18 (Mon)	Session II – Basic Laboratory Measurements, Isotopes, Age dating	
08:30-09:30	Lecture 3 : Carbonate equilibria	Prof Lee
09:40-10:40	Lecture 5 : Geochemical evolution of natural water	Prof. Schwartz
10:55-11:50	Lecture 6 : Introduction to isotope hydrology	Prof. Lee
11:50-12:55	Lunch	
13:00-14:00	Korean Language Class	
14:15-15:15	Lecture 6 : Introduction to isotope hydrology	Prof. Schwartz
15:30-16:30	Lecture 1 : Karst Hydrogeology	Prof. Lee
16:45-17:45	Lecture 2: Exercise: Flow in karst terrain	Prof. Schwartz

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Week 4

(Module 4) – Contaminant Hydrology (7.19~7.22)

(Venue : Ara room)

Date/Time	Program Description	Remarks
7.19 (Tue)	Registration	IS-Geo
09:00-09:30		
7.19 (Tue)	Session I – Contaminants in groundwater, Theory of contaminant transport	
08:30-09:30	Lecture 1 : Contaminants and types of contaminations	Prof. Schwartz
09:40-10:40	Lecture 2 : Contaminants and types of contamination Exercise: Cape Cod, MA case study	Prof. Schwartz
10:55-11:50	Lecture 3 : Contaminants and types of contamination Exercise, Leon County, FL case study	Prof. Lee
11:50-12:55	Lunch	
13:00-14:00	Korean Language Class	
14:15-15:15	Lecture 4 : Advection – theory, Exercise: Advection at Otis Air Base	Prof. Schwartz
15:30-16:30	Lecture 5 : Dispersion I – Theory & Tracer tests	Prof. Lee
16:45-17:45	Lecture 6 : Dispersion II – Quantitative treatment of dispersion	Prof. Schwartz
7.20 (Wed)	Session II – Theory of contaminant transport, NAPLs	
08:30-09:30	Lecture 1 : Exercise: Calculation of dispersivity, Diffusion	Prof. Schwartz
09:40-10:40	Lecture 2 : Key chemical reactions – sorption and biodegradation	Prof. Schwartz
10:55-11:50	Lecture 3 : Retardation, Exercise	Prof. Lee
11:50-12:55	Lunch	
13:00-14:00	Korean Language Class	
14:15-15:15	Lecture 4 : NAPLs – Organic compounds	Prof. Lee
15:30-16:30	Lecture 5 : NAPLs – Residual saturation and patterns of spreading vapor transport, petroleum hydrocarbon	Prof. Schwartz
16:45-17:45	Lecture 6 : NAPLs - Site investigations & Exercise: DNAPL spreading	Prof. Schwartz
7.21 (Thu)	Session III – NAPLs and Case Studies, Remediation	
08:30-09:30	Lecture 1 : Remediation – Containment	Prof. Schwartz
09:40-10:40	Lecture 2 : Remediation – Designing injection/withdrawal systems	Prof. Schwartz
10:55-11:50	Lecture 3 : Remediation – In situ chemical oxidation	Prof. Lee
11:50-12:55	Lunch	
13:00-14:00	Korean Language Class	
14:15-15:15	Lecture 4 : Exercise: Savage Well Superfund case study	Prof. Lee
15:30-16:30	Lecture 5 : Exercise: Savage Well Superfund case study	Prof. Schwartz
16:45-17:45	Wrap up	Prof. Schwartz
7.22 (Fri)	Field Exercise: Aquifer test	
08:30-09:30	Lecture 1 : Introduction to aquifer test demonstration(Class) I	Dr. Yongcheol Kim
09:40-10:40	Lecture 2 : Introduction to aquifer test demonstration(Class) II	
10:55-11:50	Lecture 3 : Data Collection: Head measurements, pressure head data logger installation	
11:50-12:55	Lunch	
13:00-14:00	Korean Language Class	
14:15-15:15	Lecture 4 : Aquifer test: slug test, pumping test	
15:30-16:30	Lecture 5 : Data Interpretation(Class) I	
16:45-17:45	Lecture 6 : Data Interpretation(Class) II	Prof. Lee
18:30-22:00	Individual tuition (optional - subject matter selected by participants) – Lecture course, exercise & discussion	Prof. Lee

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