:: Course Information

Agricultural and Forest Meteorology

The course focuses on understanding of the interactions between natural ecosystems and various processes in meteorology, agronomy, and forestry. Lectures on basic science and applied research deal with practical issues in vegetation, soil science, ecology, and biogeochemistry associated with changes in weather and environment. Major topics include the exchange of energy, matter and information between agroforest ecosystems and the atmosphere, micro-meteorological measurements (radiation, canopy turbulence, evapotranspiration, flux and concentration), biometeorology (crop production, light & water use efficiency, phenology, and disturbance), aerobiology (pollen, spore, dispersion of insects and pesticides), forest fire meteorology, interactions between vegetation and changes in weather and environment.

Agroforest Ecosystem and Climate Change

Based on the overall knowledge of climatology and climate change science, the interactions between agroforest ecosystems and the climate system such as food production, resource management, and ecosystem services are reviewed, analyzed and understood in the framework of systems thinking. The impacts of climate change on energy and materials exchanges, meteorological disasters, diseases, crop production, and ecosystem management are assessed and projected. Students learn about the theory and application of social-ecological systems modeling to develop scenarios to cope with change and disturbance.

Biometeorological Measurement

The course provides theoretical consideration and practices in the laboratory and field settings on experimental design, principles and calibrations in instrumentation, operation and maintenance, data processing, and quality assurance and control in the context of meteorological/climatological, ecohydrological, biogeochemical perspectives.

Ecosystem-Atmosphere Interactions

The course provides the current understanding of the interactions between the complex dynamic ecosphere and the atmosphere by reviewing the underpinning theories, modelings and reanalysis of observations on their feedback mechanism. Particularly, radiative, aerodynamic, biological and boundary-layer couplings are examined. Based on the use of dynamic vegetation model and the recent field observation data, students learn how agroforest ecosystems respond and adapt to natural and human-induced disturbances through feedback mechanism.

Biogeochemical Cycles in Complex Ecosystems

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Remote Sensing of Ecosystem Structures and Functions

The course provides available theories and techniques in ground and satellite-based remote sensing to understand the temporal and spatial patterns manifested in ecosystems structure and function. Using satellite image analysis and GIS techniques, students learn how to monitor ecosystems, to establish database, to analyze materials cycling and their mapping, various spatiotemporal scaling, and parameterization associated with modeling.

Disease Management in Agricultural and Forest Ecosystems

The course provides the lectures on the kinds of potential disease and the environmental conditions for their outbreak due to damages by veterinary sources, blight, and harmful insects. Lessons are learned by examining the case studies in the past to project future possibility of such outbreak and risks. Students learn the related basic and applied sciences such as veterinary science, pathology, environmental engineering and information technology to effectively cope with such diseases and the consequent damages.

Responsibility, Justice and Sustainability Science

Through the synergy of natural science, social science and humanities, the course encourages students to pursue consilience towards sustainability by reviewing the responsibility and justice associated with the interactions between science and the society. Students are supposed to learn the current trends in sustainability science, apply the understanding to their own majors, and practice the lesson learned in the local community. Based on the understanding of state-of-the-art sciences and human history, the interactions between diverse world views, paradigms, policy makings are examined. The course will provide students with leadership and capability to serve as science advisors who not only produce noble knowledge needed for sustainable society, but also to practice such insight in practical policy makings related to sustainability science.

Internship 1 in Agricultural and Forest Meteorology

The minimum 80 hours of internship is required for the fulfillment of master's program to obtain practical experience and in-depth knowledge under domestic and/or international organizations associated with agricultural and forest meteorology.

Internship 2 in Agricultural and Forest Meteorology

The minimum 80 hours of internship is required for the fulfillment of master's program to obtain practical experience and in-depth knowledge under domestic and/or international organizations

associated with agricultural and forest meteorology.

Experimental Design and Scientific Writing

The course provide students with essential skills required for the preparation of science proposals such as logical experimental design, research methodology, and scientific writing. Students will also learn the ethics related to the practice of science and research in the pursuit of enhanced learning.

Seminar in Agricultural and Forest Meteorology

The course aims to enhance students' ability to identify problems, to establish hypothesis, to design appropriate experiment, to select proper methodology, to interpret results logically, to draw right conclusion, and to present and effectively communicate the highlights by preparing reports related to the topics in agricultural and forest meteorology, practicing presentation, and experiencing discussion in various settings.

Thesis Seminar

In this thesis seminar, students introduce their thesis/dissertation topics with research design and contents. Through presentation and discussion towards cross-disciplinarity, students learn to enhance the quality of research study and to enlarge their scope and understanding beyond their disciplinary boundaries.

Dissertation Research 1

This is an independent study to prepare creative and quality thesis in agricultural and forest meteorology by selecting pertinent topics under the supervision of the individual's thesis advisor. Student meets on a regular basis with his/her thesis advisor to share the results, synopsis, and implications of the related literature review to make progress in thesis preparation.

Dissertation Research 2

This is an independent study to prepare creative and quality thesis in agricultural and forest meteorology by selecting pertinent topics under the supervision of the individual's thesis advisor. Student meets on a regular basis with his/her thesis advisor to share the results, synopsis, and implications of the related literature review to make progress in thesis preparation.

Experimental Design

This course provides graduate students with statistical data analysis skills in regression, correlation, and group comparison. This course will also cover the most commonly used experimental designs for single-factor and two-factor experiments with specific emphasis on corresponding

randomization, analysis of variance procedures, and computer-based statistical analysis using SAS.

Topics in Agricultural Ecology

This is an advanced course on the agricultural ecosystem: agricultural climatology and aerial environment, soil characteristics and nutrient flow, light utilization and organic matter production in the crop community. Sustainable agriculture with IPM and precision farming techniques will be emphasized.

North Korean Agriculture

Food shortage in North Korea is already well known to outside world watchers. But still a lot of people do not seem to understand why they are having such shortage. Therfore, this course is set up to show to graduate and senior undergraduate students the real situation concerning on agricultural production in North Korea - from their agricultural policy and collective farms to their actual production practices and even their agricultural education and research. This will demonstrate the real culprit in their food shortage and students will discuss ways to overcome the food crisis.

Studies in Agricultural Information System

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Soil Physics

In this course, students will: study the physical properties of soil; quantify the physical state of the soil water system in terms of density, porosity, water content, and water potential; discuss the dynamic processes of heat, water, and gas flow in soil, and use appropriate models for the description of these processes; and apply the science of soil physics to the solution of contemporary problems in water conservation, water management, prevention of soil and ground water contamination, remediation of contaminated soils and the management of plant water status.

Biological System Analysis

This course will cover the interactions between biological objects (plants and animals) and their environments (soil, water, and climate), modeling, soil, water, climate, growth environment, physiological functions, and heat and water transport. Knowledge of engineering mathematics, heat transfer, and fluid mechanics is prerequisite.

Tree Physiology

This course uses basic chemistry, physics and mathematics to explain and develop concepts for an understanding of various areas of tree physiology. This course covers the physical environment in which trees and other living organisms live. In addition this course considers the physics of heat and mass transport between trees and their surroundings. Also this course discusses physiological processes such as transpiration and photosynthesis from physical and chemical point of views.

Forest Watershed Management and Modeling

This course focuses on the hydrology and water quality processes on forest watersheds with emphasis on the effects of forest management activities including afforestation, timber harvesting and forest road construction. The course provides students with a comprehensive understanding of hydrology cycles such as canopy rainfall interception, evapotranspiration, water movement in a soil layer, surface and groundwater flows, and covers watershed management approach, riparian hydrology and hillslope hydrology. In this course we also explore the role of forest watershed modeling, review current approaches for watershed modeling, discuss parameter analysis, and model evaluation techniques for sustainable management of forest watersheds.

Topics in Forest Soil

The course intends for students to recognize practical management methods of forest soil from the viewpoint of sustainable forest management. Based on the fundamental knowledge of soil properties, students will learn the differences between agricultural soil and forest soil. The course examines physical, chemical and biological characteristics of forest soil, and develop ways to adapt those characteristics to the practical operations of forest soil management under the principle of ESSD (environmentally sound and sustainable development). The students will learn various forest soil properties and their function in the ecosystem, and develop the ability to apply the knowledge in the forest soil management.

Topics in Ecological Economics

Students will review recent development of ecological economics research and an interdisciplinary approach will be applied to the impact of economic activities on ecosystems. Some real issues in forest ecosystem management are addressed from the perspective of biophysical, philosophical, and economic theories. For empirical cases, social impacts of forest resources utilization and energy-material flows of forest utilization are analyzed.

Crop-Water Relations

The content of this course includes discussion of the principles of plant interactions with soil and water environments and their applications in crop and environment management. Topics of

interest include reactions and transport of water and mineral nutrients in soil, evapotranspiration and water balance, drought, flooding and salt stresses, aquatic environment, and adaptive growth of water plants. This course makes use of instruments and techniques for field measurement of the status of water in plant and soil, and the light and chemical environment in aquatic and paddy milieu.

Plant Structure and Function

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Plant-Environment Control and Modeling

The intents of this course are to teach the theories for plant-environment control and the modeling of plant response to environmental factors. They include environmental factors affecting crop growth, analysis of micro-meteorology, prediction of environmental changes, measurement of environmental and biological information, and theory of environmental control methods. Modelling of plant growth, photosynthesis, stomata resistance, moisture of substrate and other plant responses to environmental conditions are studied. For practical purposes, their applications to micropropagation systems, greenhouse, soilless culture, and other crop prodcuction in closed ecosystem will be reviewed.

Watershed Hydrologic Modeling

This course covers the theoretical hydrology, flood routing, stochastic analysis of hydrology to analyze the hydrologic cycle of rural watershed and agricultural land including paddy field and upland. Classification and characteristics of watershed hydrologic models will be introduced and estimation of input parameters and optimization techniques will be explained with newest research results. The state-of-the-art related to estimation and application of the parameters of hydrologic models using Geographic Information System (GIS) will be discussed. The course consists of lecture and discussion sessions, and special topics will be assigned to help understand the course contents better.

Topics in Rural Resources Information Systems

Rural resources are the important topics in rural systems engineering. Rural resources include land, water resources, green amenity, etc. Since information technology has been proliferated, information systems are doing key roles in managing the rural resources. This class introduces rural resources categories, characteristics and information systems including geographic information systems, database, and decision support system (DSS). Especially basics of web-based system development will be lectured to construct the web- based resources management DSS

students themselves for providing practical experiences of information system development.

Atmospheric Environment and Agricultural Structures

Climatology is the most basic factor among the natural environment as well as unpredictable and constantly changed. To overcome the natural environment and stably keep high-quality production through for a whole year, optimum management of air, soil and water are required while they have been successfully applied to the rural area. The purpose and design of the structures to design and mange the artificial structures should be clearly understood based on the atmospheric environment. In this class, the physical characteristics of the atmospheric environment is studied related to the structural design, and then, using the knowledge, typical technology and theories are studied which are applied to the designs of various agricultural structures Various examples of the applications are also presented audiovisually in this class.

Application of Computational Fluid Mechanics

Rural Geographic Information Systems and Remote Sensing

Foundation of Natural Science

This course discusses general characteristics and logical structures of natural sciences. The course examines the mechanical explanation of nature by classical and quantum mechanics, the concepts of space, time, and gravity according to the theory of relativity, the general theory of macroscopic changes based on the concept of entropy, and the basic theories about the nature of and the evolution of the universe and life.

Principles of Brain and Cognitive Sciences

This is a graduate class, suitable for 1st-year graduate students in Department of Brain & Cognitive Sciences (BCS) or graduate/advanced undergraduate students in other programs related to BCS. Students will be introduced to basic research principles of BCS by learning fundamental theories and major research topics in modern-day brain and cognitive neurosciences. Every and each student in the Department of BCS is required to take both this course and < Methods in Brain and Cognitive Sciences >, which is provided in conjunction with this course.

Physics of Complex Systems

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Plant Stress Physiology

Like animals, plants go through various biotic and abiotic stresses. Unlike animals, plants cannot avoid or escape from stress due to their sessile nature. Instead, plants have adopted other unique

systems to cope with the stresses. This course introduces plant defense mechanisms for both biotic and abiotic stresses. Plant developmental and biochemical strategies related to plant stress tolerance mechanisms are discussed.

Micrometeorology

This course covers the physical and dynamical methods to deal with the various atmospheric phenomena occurring in the lower atmospheric layer from surface to a few kilometers above the ground. Specific topics include the basic concepts used in micrometeorology, vertical profiles of various meteorological variables in the adiabatic surface layer, diabatic surface layer, vertical structure of atmospheric boundary layer, heat transfer into the ground, the local circulation and the urban heat island.

Numerical Modeling and Weather Prediction

Students review the atmospheric governing equations for understanding and predicting atmospheric motion systems, and learn various basic numerical techniques for atmospheric modeling. This course covers numerical solution, initial and boundary conditions, linear and nonlinear instability, energy and entropy conservation, model grid systems, coordinate systems, and data analysis.

Atmospheric Turbulence

This course studies the physics of turbulence, which includes the origin of turbulence, methods of describing turbulence, similarity theories, spectral analysis and energy cascade.

Statistical Methods in Meteorology

Advanced statistical analysis methods for meteorological data processing will be discussed in the consideration of theoretical and practical aspects. The main topics are time series analysis, regression analysis, FFT, WT, EOF, and the newly developed up to date tools.

Plant Biochemistry

In this subject, students study biochemical molecules in plants. These include primary metabolites, such as phytosterols, lipids, nucleotides, amino acids, sugars, and organic acids, that are critical for plant survival, growth, and development and secondary metabolites that are not critical but involved in diverse physiological processes, such as defense against pathogens and resistance to environmental stresses. Furthermore, what is aimed in this subject includes understanding of their functional mechanisms and related molecular biological signaling cascades and discussion about the potential ways to engineer the biological activities. Those who took biochemistry or equivalent subjects are welcome to this subject.

Physical Hydrology

The course handles each component of the hydrologic cycle such as precipitation, evapotranspiration, infiltration, runoff, groundwater using earth science theory and covers engineering techniques such as unit hydrograph, hydrologic design theory. Students learn some recent issues in hydrology including climate change, radar, GIS.

Geophysical Data Processing

This course focuses on the analysis of geophysical data processing. It deals with various prospecting data types and calculation methods for inversion and modeling.

Topics in Environmental Geochemistry

This course studies basic principles of environmental geochemistry, regional environmental geochemical mapping, geochemical analytical methods, dispersion and migration of potentially toxic elements in rock-soil-crop system, geochemistry of natural water quality, agricultural geochemistry and case studies, and holistic approach between geochemical environment and geo-epidemiology of plants-animals-humans.

Advanced Geostatistics

This course studies various kriging techniques. It covers optimization techniques to minimize uncertainty by the integration of available data.

Data Mining Technology

Data Mining Technology tries to find relations, patterns, and rules in large scale databases. Predictive modeling and descriptive modeling techniques from statistics, machine learning, and neural networks are presented. Students have a chance to learn and practice a popular data mining package.

Dynamic Systems

Concepts to be covered in this course include the following: formulation and analysis; state-space formulation, solutions of linear dynamic systems, equilibria, and dynamic diagrams; eigenvalues and eigenvectors of linear systems, and the concept of feedback; non-linear models; dynamic models of ecosystems, technology innovation, and new game creation.