

**Study Plan**  
**Faculty of Agriculture**  
**Ph.D. in Land, Water and Environment**

**First: GENERAL RULES & CONDITIONS:**

Plan Number			2013
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1. This plan confirms to the valid regulations of programs of graduate studies.
2. Specialties of Admission:
  - The First priority: M.A. in Soil, Water and Environment.
  - The Second priority: M.A. in Soil and/or Irrigation
  - The Third priority: M.A. in Agricultural Resources and Environment (Irrigation or Soil).
  - The Fourth priority: M.A. in Environmental Sciences and Management
  - The Fifth priority: M.A. in Water Resources
  - The Sixth priority: M.A. in Civil or Chemical or Environmental Engineering
3. Admission policies: The First Policy.

**Second: SPECIAL CONDITIONS:** None.

**Third: STUDY PLAN: Studying (54) Credit hours as follows:**

**1. Obligatory Courses : Studying (21) credit hours successfully:**

Course No.	Course Title	Credit Hours	Theory	Prac.	Prerequisite
0601901	Experimental Design and Analysis	3	3	-	
0604901	Treated Waste Water Reuse	3	3	-	
0604902	Land Use Planning	3	3	-	
0604903	Modeling of Environmental Systems	3	3	-	
0604904	Soil – Plant Water Relationship	3	3	-	
0604905	Water Resources Management	3	3	-	
0604919	Soil Moisture Conservation and Management.	2	2	-	
0604920	Research Methodology	1	1	-	

**2. Elective Courses: Studying (15) Credit hours successfully from the following:**

Course No.	Course Title	Credit Hours	Theory	Prac.	Prerequisite
0604906	Soil Biochemistry	3	3	-	
0604907	Surface Irrigation	3	3	-	
0604908	Agricultural Land Drainage	3	3	-	
0604909	Soil Classification (2)	3	3	-	
0604910	Remote Sensing Applications	3	3	-	
0604912	Special Topics*	3	3	-	
0604913	Plant Nutrition	3	3	-	
0601924	Sustainable Agriculture	3	3	-	
0601946	Stress Physiology	3	3	-	

\*To be studied once regardless of the Topic.

**3. Pass the qualifying Exam: (0604998)**

**4. Thesis: (18) Credit hours # (0604999).**

**Course Description**  
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**(0601901) Experimental Design and Analysis (3 Credit Hours)**

This course covers advanced statistical methods, design and analysis for agricultural research, such as incomplete block design, Lattice design and Lattice equal confounding and their uses. This course also covers combined analysis of several experiments over space and time.

**(0604901) Treated Waste Water Reuse (3 Credit Hours)**

This course includes Source, treatment methods and properties of treated sewage water; sewage water as water source; criteria, standards and guillotines of sewage water; irrigation and fertilization management (Irrigation systems for sewage water irrigation; and social acceptance.

**(0604902) Land Use Planning (3 Credit Hours)**

This course includes Basic principles or the planning process, land resources data bases, and evaluation, interpretation or soil, water and vegetation in formation, role or GIS and remote sensing, planning the use or land for agricultural and non-agricultural uses, comprehensive planning and models of and use planning.

**(0604903) Modeling of Environmental Systems (3 Credit Hours)**

This course includes Concept of systems and simulation models, descriptive and explanatory models, static and dynamic models, single and multidimensional models. Modeling process: boundary identification, components and links, model construction, parameterization, verification, calibration, sensitivity analysis and validation. Hydrological models, soil erosion models, soil and crop models. Crop simulation models: mathematical representation of the soil-plant-climate systems, Decision Support System for Agro- technology Transfer (DSSAT). Computer-based models and their applications.

**(0604904) Soil – Plant Water Relationship (3 Credit Hours)**

This course includes Role of water in the plant (cell water relations, permeability, movement of water and solutes). Water in soil (soil characteristics, water retention, water movement in soil). Roots and root growth (roots growth, function and environmental factors affecting root growth). Absorption of water (transpiration, kinds of absorption). Factors affecting water absorption (roots efficiency, water availability, soil temperature, aeration and composition of soil solute). Radiation balance (solar spectrum, radiation and duration of sunshine distribution of solar radiation, net radiation, radiation balance in greenhouse, energy exchange. Movement of water through plants, Transpiration (factors controlling transpiration. Water stress and plant growth.

**(0604905) Water Resources Management (3 Credit Hours)**

This course includes water resources management and planning. Water uses by different sectors are discussed with special emphasis on agricultural and irrigation uses. Issues related to watershed management and its effect on the hydrology and surface runoff. Potential use of flood for water harvesting and groundwater recharge will be evaluated. Different techniques for water harvestings are discussed and evaluated. Water resources use are linked to land uses. Finally the course will evaluate balance between water supply and demand. Socio-economic issues related to water resources management and uses are discussed.

**(0604906) Soil Biochemistry (3 Credit Hours)**

This course includes Energy yielding and requirements for soil microbes, degradation of carbohydrates, lignin, organic nitrogen compounds, nucleic acids, organic acids, phosphorus and sulfur compounds and pesticides degradation in soil.

**(0604907) Surface Irrigation (3 Credit Hours)**

This course includes Design, evaluation, and management of basin, border, and furrow irrigation systems, field measurements in evaluating system performance and design land leveling computation and equipment.

**(0604908) Agricultural land Drainage (3 Credit Hours)**

This course includes Drainage theories, soil potentials, relation of drainage with water quantities and land use, open and close systems of subsurface drainage, needs for drainage, surface drainage, subsurface drainage and drainage using pumps.

**(0604909) Soil Classification (2) (3 Credit Hours)**

This course includes principles and bases of soil classification, International systems of soil classification, Russian, FAO and American systems. The ten orders of the USDA soil taxonomy, and their use in land use. Numerical soil classification, soil order found in land in Jordan according to the American and FAO systems, and their distribution. Use of soil taxonomy in regional land use planning.

**(0604910) Remote Sensing Applications (3 Credit Hours)**

This course includes Remote sensing applications in vegetation studies: simple vegetation indices, advanced indices of vegetation and their relation to crop parameters. Thermograph: thermal sensors, sea surface and land surface temperature estimation. Microwave remote sensing and RADAR systems: principles and equation of microwave systems, application in soil vegetation and geological studies. Digital and aerial photography: Principles of visual interpretation of AP and satellite imagery, applications of AP in soils, vegetation, water and geological studies. Applications of remote sensing in groundwater exploration.

**(0604912) Special Topics\* (3 Credit Hours)**

This course includes emerging issues or specialized content in land, water or environment not represented in the main curriculum.

**(0604913) Plant Nutrition (3 Credit Hours)**

This course includes Nutritional aspects of plants as factors controlling crop production Nutrients uptake, translocation, assimilation and storage. Deficiency and toxicity.

**(0604919) Soil Moisture Conservation and Management (2 Credit Hours)**

This course includes the major fundamental management practices and conservation techniques that lead to reduction in water losses. The role of organic matter, conservation tillage, and residue management in soil water conservation is covered. The course also covers the impact of these conservation techniques and management practices on the long-term crop yield and net returns.

**(0604920) Research Methodology (1 Credit Hour)**

This course includes the different components of scientific research, the scientific writing of a research proposal and thesis and how to deal with scientific literature.

**(0601924) Sustainable Agriculture (3 Credit Hours)**

This course includes principles and factors affecting, the sustainability of different farming systems, including local and external factors. It also deals with the impacts of national policies and legislations, extent of resources availability, agricultural practices used. Important requirements for sustaining the resource productivity and utilization on long and short term bases will also be discussed.

**(0601946) Stress Physiology (3 Credit Hours)**

This course includes Expressions related to stress physiology and plant response to environmental stresses: temperature (freezing, chilling, high temperature, low temperature) water (flooding, drought) salinity, radiation and other stresses. Discussion to most recent stresses facing crops.

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