

<p>The Hashemite University Faculty of Natural Res. &amp; Environ. Dept. Land Management &amp; Environ. First Semester, 2011/2012</p>		<p>Dr. Mohammed I. Al-Qinna qinna@hu.edu.jo Irrigation Principles (1202322) 3 Credit Hours</p>
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### Aims:

Introduce the students to the main principles of irrigation systems, scheduling and operation in its relation to environment on the basis of the relationships between soil-water and irrigation systems. Also the course aim to provide the students with the design principles and management techniques of agricultural irrigation methods.

Course Outline	Week
<p><b>Introduction</b> Definition of Irrigation, Importance of Irrigation, Irrigation Elements, Irrigation Water Resources (Precipitation, Surface Water, Groundwater, and Treated Wastewater).</p>	1
<p><b>Soil-Water-Plant Relationships</b> Soil water concept, field capacity, permanent-wilting point, available water, water holding capacity, and water measurement techniques. Soil porosity, percentage air content, soil structure, texture, and bulk and particle densities, Soil water potential and soil moisture characteristic curve, Infiltration theories and their importance in irrigation design. Plant water requirement, root depth, salinity tolerance, leaching requirement, and percent of shaded area, Management allowable depletion and usable soil water,</p>	2
<p><b>Irrigation Scheduling</b> Irrigation depth, Irrigation Interval, Salinity Control, Irrigation Frequency.</p>	3
<p><b>Consumptive Use of Water</b> Evaporation, transpiration, and Potential evapotranspiration, Direct measuring methods (Lysimeters), Indirect Estimation Methods (Penman Monteith, FAO-24, Wright and Jensen, Wright, Jensen-Haise, Hargreaves, Blaney-Criddle, and Pan Evaporation), Crop water requirement, crop coefficient.</p>	4
<p><b>Irrigation Efficiencies</b> Application efficiency, Conveyance efficiency, Water-use efficiency, Water-storage efficiency, Water-distribution efficiency, Consumptive-use efficiency</p>	5
<p><b>Basic Hydraulic Concepts</b> Reynolds number, Darcy-Weisbach formula, Hazen-Willams formula.</p>	6-7
<p><b>Irrigation methods and components</b> <b>1. Surface Irrigation System</b> Types of Surface irrigation, When to use each type, Advantages and disadvantages, Wetting pattern, Irrigation design.</p>	8-9
<p><b>2. Sprinkler Irrigation System</b> Types of Sprinkler irrigation system, When to use each type, Advantages and disadvantages, Wetting Pattern, Sprinkle Irrigation Planning Factors, Irrigation Efficiency and Uniformity, Design and Selection of System Components, Clogging and Filtration.</p>	10-11
<p><b>3. Trickle Irrigation System</b> Advantages and disadvantages, Trickle planning factors, Emitter Selection and Design Criteria, Trickle System Design Strategy, Design and selection of system components, Installation and operation of a system, Evaluation of the system.</p>	12

<b>Pump and Power Unit Selection</b> Pump types, Pump characteristic curves, Pump selection, Power Unit Selection.	13
<b>Fertigation</b> Fertilizer materials for N, P, K, and trace elements, Computing Injections, Sprinkler Fertigation, Corrosion, Injection Equipments>	13
<b>Irrigation Management</b> Water erosion under irrigation, Salt Problems in relation to irrigation, Wind erosion control by irrigation, Irrigation practices and soil aeration, Use of Irrigation to modify soil temperature, Irrigation use for Forest Protection, Public health problems related to Irrigation, Irrigation use for wastewater applications>	14

**Books:**

1. Israelsen, O.W., and Hansen V.E. 1980. Irrigation Principles and Practices. Fourth Ed., John Wiley & Sons Inc. New York. USA.
2. Hagan, R.M, H.R. Haise, and T.W. Edmisnter.1967. Irrigation for Agricultural Lands. American Soc. of Agronomy, Madison, Wisconsin, USA.
3. Stewart, B.A. and D.R. Nielsen. 1990. Irrigation of Agricultural Crops. ASA Inc., CSSA Inc., SSSA Inc., Madison, Wisconsin, USA.
4. Keller, J. and R. Bliesner. 1990. Sprinkler and Trickle Irrigation. AVI Book. Van Nostrand Reinhold. New York.
5. Melby, P. 1995. Simplified Irrigation Design. Second Ed., John Wiley & Sons, Inc. New York. USA.
6. Stephen, S.W. 1997. Landscape Irrigation Design and Management. John Wiley & Sons, Inc. New York. USA.
7. Vermeirn, I. 1980. Localized Irrigation: Design, Installation, Operation, Evaluation. Irrigation and Drainage Water, Food & Agriculture Org; (December 1980), Rome.
8. Hargreaves, G.H., and G.P. Merkle. 2004. Irrigation Fundamentals. Water Resources Publications, LLC, Colorado, USA.

**Additional Online References:**

1. Brouwer, C., A. Goffeau, and M. Heibloem. Irrigation Water Management: Training Manual No. 1 - Introduction to Irrigation. <http://www.fao.org/docrep/T7202E/R4082E00.htm>
2. Brouwer, C., K. Prins, and M. Heibloem. Irrigation Water Management: Irrigation Scheduling. Training manual no. <http://www.fao.org/docrep/T7202E/T7202E00.htm>
3. Brouwer, C., K. Prins, M. Kay, and M. Heibloem. Irrigation Water Management: Irrigation Methods. Training manual no 5. Provisional edition. <http://www.fao.org/docrep/S8684E/S8684E00.htm>

**Evaluation:**

First Hour Exam	25%
Second Hour Exam	25%
Final Hour Exam	50%