**AEN 2210 IRRIGATION TECHNOLOGY**

Lecturer **Mr. Iwadra Michael**

 **MSc Water Resources Engineering (KULeuven, VUB, Belgium),**

 **MSc Hydrotechnics: Irrigation and Drainage Engineering**

 **(Moldavia),**

Fulltime Lecturer.

**Course Type**: **CORE (B.Sc. Horticulture Year II), Elective (B. Land Use and Management Year II)**

**1. COURSE**

**Course Credits (CU)**: **3 CU i.e. 30 Contact Hours per semester**

**Course Duration**: **15 weeks (30 hours) i.e. 15 LH, 30 PH**

**COURSE DESCRIPTION**

Irrigation principles. Evapo-transpiration. Irrigation requirements. Crop water needs. Moisture deficiency recurrence. Plant-Soil-Water relationships. Irrigation scheduling. Salinity and leaching. Irrigation methods: border, check basin, furrow, Sprinkler and drip. Measurement of irrigation water and delivery rates; land grading and field lay out; irrigation methods; design of irrigation systems and management of irrigation systems.

**2. COURSE OBJECTIVES**

**To produce graduates who**

* understand the concepts, principles and application of irrigation in enhancement of crop production
* have the basic competence in the design, installation and management of irrigation systems

**3. RECOMMENDED REFERENCES FOR READING**

* **Andreas P. S., A. S. Joop, M. A. R. Paul and V.H. Sven, 1991.** Irrigation Manual, Volume I and II**. UNDP/FAO ZIM/85/004 Project.**
* **Brouwer C. and M. Heibloem, 1985.** Introduction to irrigation**. Irrigation Water management Training manual no. 1. FAO.**
* **Brouwer C. and M. Heibloem, 1986.** Irrigation Water Needs**. Irrigation Water management Training manual no. 3. FAO.**
* **Brouwer C. and M. Heibloem, 1986.** Irrigation Methods**. Irrigation Water management Training manual no. 5. FAO.**
* **Brouwer C., J. P. Hoevenaars, B. E. Van Bosch, N. Hatcho and M. Heibloem, 1992.** Scheme Irrigation Water Needs and Supply**. Irrigation Water management Training manual no. 6. FAO.**
* **Brouwer C., J. P. Hoevenaars, B. E. Van Bosch and N. Hatcho, 1992.** Canals**. Irrigation Water management Training manual no. 7. FAO.**
* **Chin, D.A.,2000.** Water Resources Engineering**. Prentice Hall, New Jersey.**
* **Feddes R. A. and R.W. R. Koopmans, 1995.** Agrohydrology**. Department of Water Resources, Wageningen Agricultural University.**
* Hansen V. E., O. W. Israelsen and G. E. Stringham, 1962. **Irrigation Principles and Practices.** John Wiley and sons, Inc.
* **James, L.G.,1988.** Principles of Farm Irrigation System Design**. John Wiley, New York.**
* **Journal of Irrigation and Drainage Engineering, American Society of Civil Engineers**.
* **Michael, A. M., 1978.** Irrigation Theory and Practice**. Vikas Publishing House PVT, New Delhi.**
* **Punmia B. C. and B. B. L. Pande, 1987.** Irrigation and WaterPower Engineering**. N.C. Jain, Delhi.**
* **Schwab, O. G., K. R. Frevert, T. W. Edmister and K. K. Barnes, 1981.** Soil and Water Conservation Engineering**. John Wiley & Sons, New York**

**4. COURSE CONTENT, METHODS OF INSTRUCTION, TOOLS AND EQUIPMENT REQUIRED**

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| **Lecture** | **CONTENT** | **METHOD OF INSTRUCTION / Time allocated** | **TOOLS / EQUIPMENT NEEDED** |
| LECTURE 1. **Introduction to Irrigation** | * Definition of irrigation
* Introduction to irrigation principles
 | Interactive Lecture (1 hr) | LCD Projector and Screen,BB/Chalk,Maps |
| LECTURE 2. **Soil- Plant –Water****Relationships** | * Recap of Basic Soil physical properties ( texture, structure, porosity)and their relationship to soil moisture
* Methods of expression of soil moisture content
 | Lecture ( hr) | LCD Projector and Screen,BB/Chalk |
| LECTURE 3. **Soil- Plant -Water** **Relationships** | * Plant rooting depths, effective root zone, crop characteristics (stages of growth, length of growing period, etc)
* Total Available Moisture(TAM),depletion factor, Readily Available Moisture (RAM) and irrigation requirement
 | Lecture (1 hr)Field based Practical (4 hrs) on soil texture determination, Infiltrometer test | LCD Projector and Screen,BB/Chalk.Hydrometers,Chemicals,Ring Infiltrometers,Tank, Water,Transport (30 seater) |
| LECTURE 4**Evapotranspiration****(ET)**  | * Definition, factors affecting ET process
* Reference, Crop and Actual Evapotranspiration(ET)
* Direct ET measurement methods
 | Lecture (1 hr) | LCD Projector and Screen,BB/Chalk |
| LECTURE 5Evapotranspiration(ET) | * Use of equations for ET determination
 |  | LCD Projector and Screen,BB/Chalk. |
| LECTURE 6**Irrigation****Requirements.** | * Historical rainfall data, reliable and effective rainfall
* Groundwater contribution through capillary rise to the root zone
* Irrigation requirements
 | Lecture (1 hr) | LCD Projector and Screen,BB/Chalk,Probability graph paper |
| LECTURE 7**Irrigation****scheduling,****irrigation efficiency** | * Irrigation scheduling
* Irrigation efficiencies
 | Lecture (1 hr) | LCD Projector and Screen,BB/Chalk |
| LECTURE 8**Salinity and leaching** | * Irrigation water quality
* Salinity types, problems and their management in irrigated agriculture
* Leaching concept and methods
 | Lecture (1 hr) | LCD Projector and Screen,BB/Chalk |
| LECTURE 9**Surface irrigation****design and****management** | * Factors affecting Land grading (levelling) , field layout
* Land levelling design methods
 | Lecture (1 hr)Field trip-surface irrigation (6hrs) | LCD Projector and Screen,BB/ChalkTransport (60 seater) |
| LECTURE 10**Surface irrigation****design and****management** | * Basic Furrow, border and basin irrigation water application method design
* Measurement of irrigation water (weirs, flumes, division boxes, siphons, etc)
 | Lecture (1 hr) | LCD Projector and Screen,BB/Chalk |
| LECTURE 11**Basic pipe****hydraulics and****Sprinkler irrigation****design and****management**  | * Friction head loss in pipe flow hydraulics, the moody diagram, head loss in pipes with multiple openings
* Components of sprinkler irrigation system, accessories, selection of appropriate sprinkler head
 | Lecture (1 hr)Field trip –sprinkler irrigation (6 hrs) | LCD Projector and Screen,BB/ChalkTransport (60 seater) |
| LECTURE 12**Sprinkler irrigation****design and****management**  | * Basic design of lateral, sub main and main pipe lines
* Installation of sprinkler system, operation maintenance and management
 | Lecture (1 hr)Field based Practical on uniformity test (4 hrs) | Buckets,Plastic cups,Tape measure,Transport (60 seater) |
| LECTURE 13**Drip irrigation****design and****management** | * Components of drip irrigation system, selection of appropriate drip lines
* Basic design of lateral, manifold, sub main and pipe
* Installation drip system, operation maintenance and management
 | Lecture (1 hr)Design exercise ( seminar)(6 hrs) | LCD Projector and Screen,BB/ChalkFlip charts,Markers,Graphs  |
| LECTURE 14**Pumps and power unit** | * Classification of pumps
* Centrifugal pumps, affinity laws, , NPSH, cavitation, suction lift, connection in parallel and series
 | Lecture (1 hr) | LCD Projector and Screen,BB/Chalk |
| LECTURE 15**Pumps and power unit** | * Pump efficiency, water horsepower, brake horse power,
* Selection of pump and power unit
* Operation and maintenance
 | Lecture (1 hr)Field visit Practical on pump installation and priming (4 hrs) | Buckets,Transport (60 seater) |

**5. SUMMARY OF TIME NEEDED**

Interactive lectures covering theory 15 hrs

Class and station-based practical 12 hrs

Field visits 12 hrs

Seminars 06 hrs

**6. OVERALL COURSE EVALUATION**

Continuous Assessment Test 20%

* At least 2 tests ( first after lecture 8 and second after lecture 12)
* Marked out of 20 each
* Continuous Assessment (Assignments, practical, Field work) 20%
* At least 1 assignment
* Practical
* Field trip by attendance
* Marked out of 20 each

Final examination 60%