**FINAL EXAM topics**

**Agricultural Water Management Engineering MSc program**

University of Debrecen

Faculty of Agricultural and Food Sciences and Environmental Management

Topics A

Agricultural water management in general

Global water resources, hydrological cycle, dynamic and static elements of the water cycle, surface and groundwater resources.

Mechanism of surface formation and sediment transport of water courses, geo- and hydromorphology of catchments. River control procedures and hydrometric measurement methods.

Physical, chemical and biological qualification of surface water bodies, self-purification of waters and eutrophication, rehabilitation of wetlands.

Behaviour of organic and inorganic pollutants in surface water and groundwater, ecological and water-related risks.

Physical and chemical water treatment technologies, water quality criteria in relation to water utilization. Water quality protection against various water pollutants.

Quality criteria and quality improvement of surface water and groundwater resources used for irrigation. Soil degradation processes and soil reclamation methods.

Regional aspects of global climate change - atmospheric processes, meteorological and microclimatic factors affecting water resources.

Water transport in saturated and unsaturated soils. Important soil physical parameters in agricultural water management. The role of shallow groundwater in agricultural water management, installation of monitoring wells.

Soil protection, environmental protection and nature protection plans for irrigation purposes.

Formation mechanism of temporary excess (surface) water cover and its adverse effects on soil quality and crop production. Management practices to avoid its formation.

Role of wetlands in nature conservation, nature conservation practices in Natura 2000 wetlands. Characterization, construction and maintenance of wetlands.

Relations between aquatic biocommunities and their environment, natural wetlands.

Floodplain management practices.

Methods for determining soil water resources and plant water requirements.

Physiological water demand, water stress and water supply demand of irrigated plant species. Relationship between nutrient supply, plant water consumption, and water utilization.

Geographic information system (GIS) model concept of runoff, accumulation and infiltration calculations.

Application of remote sensing technology and remote sensing data in agricultural water management.

Types of drought, examples for national drought strategies and drought management plans. Calculation and evaluation of agricultural drought indicators.

Significant Water Management Issues (SWMIs) in the Danube River Basin District

Possibilities and practices of agricultural water storage and retention. Water management in forestry.

The structure of EU water acquis: EU water policy developements (Water Framework

Directive).

Practice of integrated river basin management, river basin management planning.

Urban Waste Water Treatment Directive Practices of integrated urban water management.

Green Direct Payments in the EU crop diversification, maintenance of permanent grassland, management of ecological focus areas (EFAs)

Economic evaluation of investment and maintenance costs and returns of irrigation management in crop production and horticulture.

Topics B

Agricultural water management methods and tools

Irrigation technologies in crop and fruit production.

Irrigation technologies in vegetable production. Irrigation technologies in greenhouses.

Urban wastewater treatment technologies. Semi-natural wastewater treatment methods.

Agricultural utilization potential and limitations of municipal wastewater, sewage sludge, and composted sewage sludge. Rules and technical solutions for slurry management, storage and application on field.

Agrometeorological aspects of water management. Calculation and measurement of evapotranspiration. Design and operation of automated agrometeorological stations.

Drinking water demand, supply and water quality requirements in animal husbandry. Types of pond cultures, population structure of fishponds, operation of fish farms and fishponds.

Intensive fish production systems. Dominant fish species, fish breeding technologies.

Flood plain management and flood protection techniques.

Construction and operation of wells for irrigation purposes.

Pump types, pumping stations. Water extraction, sizing and operation of pumps.

Hydraulic characteristics of closed pipelines. Construction and design of irrigation pipelines.

Water level control, methods and structures of water governance. Structure and operation of irrigation drums, sprinkler lateral and sprinkling irrigation machine with cantilever.

Structure and operation of the linear (lateral moving) irrigation systems. Structure and operation of the center pivot systems.

Structure and operation of the micro-irrigation systems. Design of irrigation norms, irrigation scheduling in optimal and water-deficient cases.

Melioration of high-lands. Erosion calculation, erosion prevention.

Melioration of lowlands. Technical tasks of spatial planning in lowland areas, equipment of surface and subsurface melioration.

Channel design, construction and operation. Hydraulic characteristics of open channels.

Objectives of drainage, types of drainage systems in excess water (temporary water cover) management. Design aspects, implementation and maintenance of combined drainage systems.

Complex melioration plans, economic evaluation of melioration.

Application of the ArcGIS software package in water management practices.

The purpose, equipment, practice, conditions and limitations of precision crop production.

Precision irrigation (Variable Rate Irrigation).

Irrigation for special purposes (pre-sowing, pre-plant, frost protection, fruit coloration, fertigation).

Hydroponic and aeroponic farming systems.

Irrigation of parks and sports courts.