



MICRO IRRIGATION ENGINEERING

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IIT Kharagpur

PRE-REQUISITES : B. Tech in Agricultural Engineering/Civil Engineering.; M.Sc in Horticulture/Soil Science/Agronomy

INTENDED AUDIENCE : Students and Faculty of Agricultural Universities, IIT, NIT, Micro irrigation Industry professionals, Researchers working in the area of Precision Agriculture and Entrepreneurs.

INDUSTRIES APPLICABLE TO : Netafim Irrigation India Pvt. Ltd., Vadodara (Gujarat); Jain Irrigation Systems Limited, Jalgaon (Maharashtra); Premier Irrigation Adritec Pvt. Ltd, Kolkata (West Bengal); Kothari Drip Irrigation Systems Ltd, Kunnathur (Tamil Nadu) ; Rivulis Irrigation India Pvt. Ltd., Secunderabad (Telangana)

COURSE OUTLINE :

Water scarcity and inefficient water resource management technologies are the main challenges in developing countries like India. India has only 4% of the World's freshwater resources, out of which 85 % of water is used for agriculture. Irrigation is the backbone of agriculture, and the efficient utilisation of irrigation water is possible only by the adoption of highly efficient irrigation methods, such as micro irrigation. Micro-irrigation provides water to plant(s) in precise amount, at right time and at appropriate place. In this course contains the basic fundamentals of fluid mechanics, flow through pump, filters, pipes and water dispensing from fine small orifices. The course also covers design, installation, operation, automation and evaluation of micro-irrigation system. This course will be useful to the Graduate, Post Graduate and Ph. D students of Agricultural Engineering, Civil Engineering, and Agricultural Science. This course will also be useful to Micro-Irrigation Industry professionals and field practising Engineers.

ABOUT INSTRUCTOR :

Prof. Kamlesh Narayan Tiwari is Emeritus Professor, at Agricultural and Food Engineering Department of IIT Kharagpur. Prof. Tiwari has more than 36 years of experience in the field of Irrigation and Water resources Management. He has taught several courses related to Land and Water Resource Engineering to UG/PG/PhD students. He has developed infrastructure for conducting indoor irrigation and On Farm field irrigation laboratory and demonstration set-up of Microirrigation System at Agricultural and Food Engineering Department, IIT Kharagpur. Major research infrastructure facilities are developed in the field of micro irrigation in field crops, protected cultivation structures, hydrology, water balance monitoring system in the experimental farm at IIT Kharagpur and Digital Image Processing facilities which are unique in the country and the World. He has developed Hardware and Software for precise application of water to the plants irrigated using Micro Irrigation (MI). Seven Patents are to his credit on these innovations. He has been the Principal Investigator of more than 10 Sponsored Research Projects dealing with water conservation and management which are the thrust areas of Water Resources and management Development having national importance. Prof. K. N. Tiwari has published more than 100 research papers in the Journals of Internationally Repute, 2 International monographs on Remote Sensing Applications, training manuals and technical bulletins. He received UNESCO and DAAD Fellowships for Post Doctoral research studies. He has been honoured with the Fellow of the i) Indian Water Resources Society (IWRS), ii) Indian Society of Agricultural Engineers, iii) National Academy of Sciences (NASc) India, and iv) National Academy of Agricultural Sciences (NAAS). He is recipient of i) Eminent Water Resources Scientist Award (2016) of IIT Roorkee, ii) Rafi Ahmed Kidwai award (2014) of ICAR, New Delhi, iii) Hari Krishna Shastri Memorial award (2013) of IARI, New Delhi, iv) Shankar Memorial award (1998) of ISAE, and v) Commendation Medal (1994) from ISAE.

COURSE PLAN :

Week 1:

Lecture 1: Micro-Irrigation: Introduction and Scope

Lecture 2: Fundamentals of Fluid Mechanics and its Application in Micro Irrigation

Lecture 3: Soil Water Concept

Lecture 4: Soil Water Constants and Infiltration

Lecture 5: Tutorial 1-Numerical Examples on Fluid Mechanics and Soil Water

Week 2 :

Lecture 6: Evapotranspiration

Lecture 7: Determination of Evapotranspiration

Lecture 8: Crop Coefficients and Crop Water Requirement

Lecture 9: Demonstration of Agro-Meteorological Instruments

Lecture 10: Demonstration of Lysimeter

Lecture 11: Tutorial 2 - Numerical Examples on Crop Water Requirement

Week 3 :

Lecture 12: Irrigation Scheduling

Lecture 13: Soil and Plant Water Monitoring Instruments

Lecture 14: Measurement of Irrigation Water

Lecture 15: Irrigation Efficiency

Lecture 16: Tutorial 3 - Numerical Examples on Irrigation Water Management

Week 4:

Lecture 17: Introduction of Water Lifts and Pumps

Lecture 18: Variable Displacement Pumps

Lecture 19: Irrigation Water Quality

Lecture 20: Tutorial 4 - Numerical Examples on Water Measurements and Pumps

Lecture 21: Irrigation Methods

Week 5:

Lecture 22: Micro Irrigation System: Concept and Types

Lecture 23: Drip Irrigation: Introduction and Types

Lecture 24: Drip Irrigation: Design Considerations & System Layout

Lecture 25: Types and Selection of Emission Devices

Lecture 26: Hydraulics of Drip Irrigation System Pipe Network

Week 6:

Lecture 27: Tutorial 5 - Numerical Example on Design of Drip Irrigation System

Lecture 28: Fertigation

Lecture 29: Fertigation Application Methods

Lecture 30: Drip Irrigation: Filtration System

Lecture 31: Tutorial 6 - Numerical Examples on Emission Devices and Fertigation

Week 7:

Lecture 32: Installation and Operation of Drip Irrigation System

Lecture 33: Maintenance of Drip Irrigation System

Lecture 34: Demonstration of Drip Irrigation Components and Evaluation of Drip Emitters

Lecture 35: Soil Water Movement under a Drip Emitter

Lecture 36: Design and Development of Drip Emitters

Week 8:

Lecture 37: Tutorial 7- Numerical Examples on Drip Irrigation System

Lecture 38: Micro Sprinkler Irrigation System

Lecture 39: Bubbler Irrigation System

Lecture 40: Sprinkler Irrigation System

Lecture 41: Sprinkler Irrigation System Design

Week 9 :

Lecture 42: Performance Evaluation of Sprinkler Irrigation System

Lecture 43: Tutorial 8 - Numerical Examples on Sprinkler Irrigation System

Lecture 44: Tutorial 9 - Numerical Examples on Design of Sprinkler Irrigation System

Lecture 45: Sprinkler Irrigation System: Layout, Installation, Operation and Maintenance

Week 10:

Lecture 46: Standards and Quality Assurance of Drip Irrigation System Components

Lecture 47: Standards and Quality Assurance of Sprinkler Irrigation System Components

Lecture 48: Solar PV System for Irrigation (Part 1)

Lecture 49: Solar PV System for Irrigation (Part 2)

Lecture 50: Tutorial 10 - Numerical Examples on Solar PV Irrigation System

Week 11:

Lecture 51: Automation of Micro Irrigation System (Part 1)

Lecture 52: Automation of Micro Irrigation System (Part 2)

Lecture 53: Automation of Micro Irrigation System (Part 3)

Lecture 54: Automation of Micro Irrigation System (Part 4)

Lecture 55: Economic Analysis of MIS (Part 1)

Week 12:

Lecture 56: Economic Analysis of MIS (Part 2)

Lecture 57: Economic Analysis of MIS (Part 3)

Lecture 58: Tutorial 11- Numerical Examples on Economics of MIS

Lecture 59: Precision Agriculture

Lecture 60: Micro Irrigation Engineering: Epilogue