Semester	**:**	**V**		
Course No.	**:**	**IDE-352**	**Credit Hrs.**	**: 4(3+1)**
Course Title	**:**	**Irrigation and Drainage Engineering**		

SYLLABUS

Objectives : (i) To make students acquainted with different methods of irrigation depending on the crop water requirement,

(ii) To understand different drainage solutions depending on specific situations,

(iii) To demonstrate the concepts through experimentation.

THEORY

Major and medium irrigation schemes of India, purpose of irrigation, merits and demerits of irrigation, source of irrigation water, present status of development and utilization of different water resources of the country; Measurement of irrigation water: weir, flumes and orifices and other methods, Design and lining of irrigation field channels, on-farm structures for water conveyance, control and distribution; Underground pipe conveyance system: components and design; land grading; Criteria for land leveling, land levelling design methods; Soil-water-plant relationship: soil properties influencing irrigation management, soil water movement, infiltration, soil water potential, soil moisture characteristics, soil moisture constants, measurement of soil moisture, moisture stress and plant response; Water requirement of crops: concept of evapotranspiration (ET), measurement and estimation of ET, water and irrigation requirement of crops, depth of irrigation, frequency of irrigation, irrigation efficiencies; Surface methods of water application: border, check basin and furrow irrigation- adaptability, specification and design considerations; Water logging-causes and impacts; Drainage, objectives of drainage, familiarization with the drainage problems of the state, drainage coefficient; Surface drainage, types and design; Sub-surface drainage: purpose and benefits, investigations of design parameters, hydraulic conductivity, drainable porosity, water table etc., types and use of subsurface drainage system, interceptor and relief drains. Derivation of Hooghoudt's and Ernst's drain spacing equations; Design of subsurface drainage system, drainage materials, drainage pipes, drain envelope; Layout, construction and installation of drains; Drainage structures, vertical drainage, biodrainage, tile drains, mole drain; Salt balance, reclamation of saline and alkaline soils, leaching requirements; Conjunctive use of fresh and saline waters.

PRACTICAL

Measurement of soil moisture by different instruments; Measurement of irrigation water; Measurement of infiltration characteristics; Determination of bulk density, field capacity and wilting point; Estimation of evapotranspiration and water requirement of crops; Study on scheduling of irrigation of field crops; Study of advance, recession and computation of infiltration opportunity time; infiltration by inflow-outflow method; Study on evaluation of border irrigation method; evaluation of furrow irrigation method; evaluation of check basin irrigation method; Study on *in-situ* measurement of hydraulic conductivity by auger hole method; Study on drainage coefficients determination; Study of piezometer, observation well and measurement of water table; Preparation of iso-bath maps; Design of surface drainage systems; Design and installation of subsurface drainage systems; Determination of various chemical properties of soil and water; Study of tile drainage; Cost analysis of surface and subsurface drainage system; Visit to a waterlogged area and Study of a drainage project.

TEACHING SCHEDULE

THEORY [IDE-352]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1 - 3	Irrigation	Purpose of irrigation, Merits and demerits of irrigation, Source of irrigation water, Present status of development and utilization of different water resources of the country; Major and Medium irrigation schemes of India.	5
4 - 8	Measurement of Irrigation Water	Measurement of irrigation water, weir, flumes and orifices and other methods	10
9 - 14	Water Conveyance	Design and lining of irrigation field channels, On-farm structures for water conveyance, Control and distribution, Underground pipe conveyance system: components and design.	10
15 - 16	Land Leveling	Land grading; Criteria for land leveling, Land leveling design methods	5
17 - 20	Soil-water-plant relationship	Soil properties influencing irrigation management, Soil water movement, infiltration, Soil water potential, Soil moisture characteristics, Soil moisture constants, Measurement of soil moisture, moisture stress and plant response.	10

Continued…

21 - 24	Water Requirement of Crops	Concept of Evapotranspiration (ET), Measurement and estimation of ET, water and irrigation requirement of crops, depth of irrigation, frequency of irrigation, irrigation efficiencies.	10
25 - 28	Surface Irrigation Methods	Surface methods of water application: Border, check basin and furrow irrigation-adaptability, specification and design considerations.	10
29 - 31	Drainage	Water logging- causes and impacts; Objectives of drainage, Familiarization with the drainage problems of the state, Drainage coefficient.	5
32 - 33	Surface Drainage	Surface drainage, Types and Design	5
34 - 37	Sub-Surface Drainage	Purpose and Benefits, Investigations of design parameters, Hydraulic conductivity, Drainable porosity, Water table etc., Types and use of subsurface drainage system, interceptor and relief drains.	10
38 - 44	Subsurface Drainage Design	Derivation of Hooghoudt's and Ernst's drain spacing equations; Design of subsurface drainage system, drainage materials, drainage pipes, drain envelope; Layout, construction and installation of drains; Drainage structures, vertical drainage, biodrainage, tile drains, mole drain.	10
45 - 48	Salt Balance	Salt balance, Reclamation of saline and alkaline soils, Leaching requirements; Conjunctive use of fresh and saline waters.	10
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [IDE-352]

Exercise No.	Exercise Title
1	Measurement of soil moisture by different instruments
2	Measurement of irrigation water
3	Measurement of infiltration characteristics
4	Determination of bulk density, field capacity and wilting point
5	Estimation of evapotranspiration and water requirement of crops, Study on scheduling of irrigation of field crops.
6	Study of advance, recession and computation of infiltration opportunity time.
7	Study of infiltration by inflow-outflow method, Evaluation of furrow irrigation method.
8	Study on evaluation of border irrigation method.
9	Evaluation of check basin irrigation method
10	Study on *in-situ* measurement of hydraulic conductivity by auger hole method.
11	Study of piezometer, observation well and measurement of water table, Preparation of iso-bath maps.
12	Study on drainage coefficients determination, design of surface drainage systems.
13	Design and installation of subsurface drainage systems.
14	Determination of various chemical properties of soil and water.
15	Study of tile drainage; cost analysis of surface and subsurface drainage system.
16	Visit to a Waterlogged area and Study of a Drainage project.

Suggested Readings [IDE-352]:

1. Michael A.M. 2012. Irrigation Theory and Practice, Vikas Publishing House Pvt. Ltd., Noida.
2. Michael A.M and Ojha T.P. 2014 Principles of Agricultural Engineering. Vol II, 5th Edition Jain Brothers Publications, New Delhi- 5.
3. Tiwari K.N. and Raghuwanshi N.S. Irrigation Engineering, ICAR Publications, New Delhi.
4. Israelsen O.W., Hansel V.E. and Stringham G.E. 1980 Irrigation Principles and Practice, John Wiley & Sons, Inc. USA
5. Luthin J.N. 2007. Drainage Engineering, Wiley Eastern Pvt. Ltd., New Delhi.

6. Bhattacharya A.K. Drainage Engineering, ICAR Publications, New Delhi.
7. Bhattacharya A.K. and Michael A.M. 2013. Land Drainage, Principles, Methods and Applications, Vikas Publishing House Pvt. Ltd, Noida.
8. Gupta, S.K. 2019. Drainage Engineering: Principles and Practices. Scientific Publishers (India).
9. Jha M.K. and Yellareddy K. Drainage Engineering, ICAR Publications, New Delhi.
10. Murthy V.V.N. and Jha M.K. 2013. Land and Water Management Engineering, Kalyani Publishers, New Delhi
11. Allen R.G., Pereira L.S., Raes D. and Smith M. 1998. Crop Evapotranspiration (Guidelines for Computing Crop Water Requirements) FAO-56 Paper.
12. Sahasrabudhe S.R. 2018. Irrigation Engineering and Hydraulic Structures, (3rd Edition), S.K. Kataria and Sons, New Delhi.
13. Majumdar D.K. 2013. Irrigation Water Management Principles. PHI Learning Private Limited, New Delhi.
14. Panigrahi B. 2013. A Handbook on Irrigation and Drainage, New India Publishing Agency, New Delhi.
15. Ritzema H.P. 1994. Drainage Principles and Applications. (2nd Edition), ILRI Publications 16, Wageningen.