

16AG307 DRAINAGE ENGINEERING

Hours Per Week :

L	T	P	C
2	-	2	3

Total Hours :

L	T	P	WA/RA	SSH/HS	CS	SA	S	BS
30	-	30	5	40	5	8	5	-



Course Description and Objectives:

This course deals with the importance of drainage and the design of different drainage structures and their mechanisms. The objective of this course is to design appropriate techniques for effective drainage systems.

Course Outcomes:

The student will be able to:

- solve drainage problems in agricultural lands.
- understand usefulness and design considerations under steady and non-steady state drainage.
- acquire information on different drainage systems components and structures.
- calculate subsurface flow by using different equations.
- understand, analysis and finding the different solutions for drainage problems in agricultural field.
- understand water flow principle through soil towards drain and different drainage system techniques, installation and maintenances.

SKILLS:

- ✓ Solve an identified agricultural drainage problem.
- ✓ Economic design, installation and maintenance of drainage layouts.
- ✓ Measure water flow through soil, recording water level using observation well and/ piezometers.
- ✓ Prepare isobath and isobar maps for different places.
- ✓ Understand the usefulness and design consideration under steady and non-steady state drainage.

ACTIVITIES:

- Visit to perceive the waterlogged field conditions for select types of drainage system required.
- Installation and test of piezometer, observation well and analysis of data.
- Measurement of various in-situ or laboratory methods for design and testing of drainage system.
- Operation of various machines and equipment for installation and maintenance of drainage system.
- Preparation of isobath and isobar maps by manually or using software.

UNIT - 1**L-06**

INTRODUCTION TO DRAINAGE : Drainage definition, Need for land drainage, History of land drainage, Familiarization with the drainage problems of the State, Design considerations for land drainage, Introduction of different land drainage system, Definitions of parameters in drainage equations- Hydraulic conductivity, Transmissivity, Drainable porosity, Drainage coefficient.

UNIT - 2**L-06**

SUB-SURFACE FLOW : Subsurface flow to drains, Steady state equations, Hooghoudt's equation derivation, Importance of equivalent depth, Ernst equation derivation, Horizontal, Vertical and radial flow; Unsteady state equations-Glover-Dumn equation, Comparison between steady state and unsteady state.

UNIT - 3**L-06**

SURFACE DRAINAGE SYSTEM : Introduction, Bedding, Field drains, Field laterals, Layout of field drains and laterals, Diversion or interceptor drains, Subsurface drainage systems, Drain materials, Envelopes-Filters and surrounds, Functions of envelope, Envelope materials, Envelope requirements in relation to soil characteristics, Gravel envelopes, Organic envelopes, Synthetic envelopes, Layout, construction and installation of drains.

UNIT - 4**L-06**

DRAINAGE STRUCTURES : Introduction, Tube well drainage, Physical and economic feasibility, Mole drainage, Hydraulics of Drainage pipes, Manning's equation for pipe flow hydraulic gradient and slope, Investigations of drain design parameters through drain testing hydraulic conductivity, transmissivity, drainable porosity.

UNIT - 5**L-06**

DRAINAGE DESIGN: Observation wells and their installation, Recording water table data and drain discharges, Drainage of irrigated and humid areas, Salt balance, Reclamation of saline and alkaline soil, Leaching requirements, Conjunctive use of fresh and saline water, Economic aspects of drainage.

LABORATORY EXPERIMENTS**LIST OF EXPERIMENTS****Total hours: 30**

1. In-situ measurement of hydraulic conductivity.
2. Determination of drainage coefficients.
3. Installation of piezometer and observation well.
4. Preparation of isobath and isobar maps.
5. Measurement of hydraulic conductivity and drainable porosity.
6. Design of surface drainage systems.
7. Design of subsurface drainage systems.
8. Determination of chemical properties of soil and water.
9. Fabrication of drainage tiles.
10. Testing of drainage tiles.
11. Determination of gypsum requirement for land reclamation.
12. Installation of sub-surface drainage system.
13. Cost analysis of surface and sub-surface drainage system.

TEXT BOOKS:

1. J. Luthin, "Drainage Engineering", 2nd edition, John Wiley and Sons, New York, 1987.
2. A. M. Michael and T. P. Ojha, "Principles of Agricultural Engineering (Vol. II)", 3rd edition, Jain Brothers, New Delhi, 2013.

REFERENCE BOOKS:

1. K. Lambert, D. Smedema, W. Rycroft, "Land Drainage: Planning and Design of Agricultural Drainage Systems", Cornell University Press, Ithaca, New York, 1983.
2. H. P. Ritzema, "Drainage Principles and Applications", 2nd edition, ILRI Publication, Wageningen, The Netherlands, 1994.
3. V. V. N. Murty and M. K. Jha, "Land and Water Management Engineering", 6th edition, Kalyani Publishers, 2013.
4. E. K. Mathew, M. S. Nair, T. D. Raju and U. Jayakumaran, "Drainage Digest", Kerala Agricultural University, Thrissur, 2004.
5. P. Waller and M. Yitayew, "Irrigation and Drainage Engineering", Springer International Publishing AG, Switzerland, 2015.
6. P. J. Dieleman and B. D. Trafford, "Drainage Testing", Irrigation and Drainage paper No. 28, FAO, United Nations, 1976.

WEB LINK:

- 1 http://ecourses.iasri.res.in/e-Learningdownload3_new.aspx?Degree_Id=04