

## **Drainage Engineering 2(1+1)**

### **Theory**

Water logging- causes and impacts; drainage, objectives of drainage, familiarization with the drainage problems of the state; surface drainage coefficient, types of surface drainage, design of surface drains; sub-surface drainage: purpose and benefits, investigations of design parameters hydraulic conductivity, drainable porosity, water table; 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; bio-drainage; mole drains; salt balance, reclamation of saline and alkaline soils, leaching requirements, conjunctive use of fresh and saline water.

### **Practical:-**

In-situ measurement of hydraulic conductivity by single auger hole and inverse auger hole method; Estimation of drainage coefficients; installation of piezometer and observation wells; preparation of iso-bath and isobar maps; determination of drainable porosity; design of surface drainage systems; design of gravel envelop; design of subsurface drainage systems; determination of chemical properties of soil and water; study of drainage tiles and pipes; installation of sub-surface drainage system; cost analysis of surface and sub-surface drainage system.

### **Suggested Readings:-**

- Bhattacharya AK and Michael AM. 2013. Land Drainage, Principles , Methods and Applications. Vikas Publication House, Noida (UP).
- Ritzema H.P. 1994 Drainage Principles and Applications, ILRI Publication 16, Second Edition (Completely Revised).
- Michael AM. and Ojha TP. 2014. Principles of Agricultural Engineering Vol-II 5th Edition. Jain Brothers Publication, New Delhi.
- Kadam U.S., Thokal R.T., Gorantiwar S.D. and Powar A.G. 2007. Agricultural Drainage Principles and Practices, Westville Publishing House.
- FAO Irrigation and Drainage Paper No. 6, 9, 15, 16, 28 and 38. Rome, Italy.