EXTENDED LECTURE OUTLINE

IDE6 311 **Irrigation and Drainage Engineering** **(3+1)**

Week.	Topics
1	**Irrigation:** Definition of Irrigation- purpose of irrigation, merits and demerits of irrigation, sources of irrigation water, present status of water resources in India and their utilization. Major and medium irrigation schemes in India.
2	**Measurement of irrigation water-**Methods of water measurement, volumetric measurement, area-velocity method-Float method, current meter method, tracer method. Units of measurement of water.
3	**Weirs**- rectangular weir, Cipolletti weir, Orifices, notches- v notches flumes- Parshall flume and tracer method. Terminologies related to weirs-weir pond, weir crest, weir broad crested weir, head, end contraction, nappe problems on weirs.
4	**Open channel water conveyance system:** design and lining of irrigation field channels. Lined and unlined channels – Advantages, dis advantages, materials used for lining canals / channels. Elements of open channel, design and lining of irrigation field channels.
5	**Soil-water-plant relationship-**soil properties influencing irrigation management-soil structure, soil depth, soil texture, soil water movement, infiltration factors affecting infiltration, Soil water potential and soil water tension. Soil moisture characteristics curves, soil moisture measurement. Water holding capacity (WHC) and Available soil moisture. Classification of soil water-Gravitational water, capillary water, hygroscopic water
6	**Water requirement and Irrigation requirement of crops.** Concepts of consumptive use and evapo-transpiration. **Measurement evapo-transpiration**. **-**Potential Evapotranspiration (PET)/Reference crop evapotranspiration.
7	Measurement of Evapotranspiration -Lysimeter experiments, Field experimental plots, Soil moisture depletion studies and water balance method. Blaney-Criddle Method, Thornthwaite method, Hargreaves equation, Pan evaporation method, Radiation method, Penman method, Modified penman method, FAO Penman-Monteith equation.
8	**On-farm structures for water conveyance**, control and distribution-structures to control erosion in channels -open drop structures, pipe drop structure and chute spillways. Water control and diversion structures-check gates, turnouts, siphon tubes, structures for road crossing- culverts. Underground pipe conveyance system and components.
9	**Land leveling and grading.** Rough leveling, land leveling and smooth leveling. Land leveling design methods. Plane method, Profile method, Plan inspection method, Contour-adjustment method.
10	**Surface methods of water application:** Border, check basin and furrow irrigation-adoptability, specification and design considerations;
11	**Land leveling and grading.** Rough leveling, land leveling and smooth leveling. Land leveling design methods. Plane method, Profile method, Plan inspection method, Contour-adjustment method.

12	Irrigation scheduling method - soil indicators, climatological, plant indices. Advantages of irrigation scheduling, Depth and frequency of irrigation.
13	**Land drainage** - definition, objectives of drainage, importance in agriculture. Waterlogging- causes and effects of water logging, categorization of waterlogged areas, problems created by waterlogged areas and control of waterlogged areas. Solving numerical problems on surface drainage.
14	**Drainage systems** - surface, subsurface and vertical drainage system and other special types of drainage system-**mole drainage system**, vertical drainage and bio drainage. Surface drainage systems – random field drainage system, parallel field and parallel open field ditch and bedding systems. Drainage co-efficient and design of sub surface drainage system.
15	**Drainage investigations** - soil characteristics, observation wells, piezometers, drainable pore space, hydraulic conductivity.
16	**Drainage coefficient,** design of surface drain systems – Hydrologic design of open drain, rational method, curve number method. Hydraulic design of open drain-capacity of ditches-ditch cross-section, design velocity. Derivation of Hoogoudts and Ernst equation for drain spacing, design of SSD, layout, construction and installation of pipe drain systems.
17	**Pipe drainage components**/ structures and Drainage materials- pipes and envelopes, functions of envelop material.
18	Subsurface drainage systems types- open drain and pipe drain system. Singular and composite drainage system, interceptor and relief drans. Salt balance, reclamation of saline and alkaline soils, leaching requirements, Conjunctive use of fresh and saline water.

List of Practicals

Practical No.	Title
1.	Studies of various irrigation water measurement methods: Volume measurement
2.	Studies of various irrigation water measurement methods: Discharge measurement
3.	Design of open channels for conveyance of irrigation water
4.	Design of underground pipeline system for conveyance of irrigation water
5.	Measurement of soil moisture by Gravimetric Method
6.	Measurement of soil moisture by Tensiometer or Irrometer
7.	Measurement of soil moisture by Gypsum Block or Resistivity meter
8.	Determination of field capacity and permanent wilting point
9.	Studies of infiltration characteristics of soil.
10.	Measurement of bulk density of soil
11.	Studies of various methods for land leveling designs
12.	Exercise on estimation of evapotranspiration.

13.	Study of advance, recession and computation of infiltration opportunity time
14.	Estimation of infiltration by inflow-outflow method
15.	Evaluation of border irrigation method
16.	Evaluation of furrow irrigation method
17.	Evaluation of check basin irrigation method
18.	Exercise on estimation of irrigation efficiency

Reference Books:

1. Agricultural Engineering Vol. II – A. M. Michael and T. P. Ojha
2. Irrigation: Theory and Practices - A. M. Michael
3. Irrigation Agronomy – S. R. Reddy and G. K. Reddy
4. Recent advances in irrigation water management by Mahendra Singh Pal
5. Irrigation and water management by Mukund Joshi.
6. Irrigation Engineering, principles, processes, procedures, design and management by V P Singh.
7. Treatise on land and water management Engineering by Jatoth Veeranna.
8. Drainage Engineering by Bhattacharya. A.K.
9. Land and water management engineering by V. V. N. Murthy.
10. Drainage principles and Applications. ILRI, Pub. By Ritzema.