

Course Code : AEN 402

Course Title : Principles and Practices of Farm Water Management

Credit Hours : 3 (2+1) Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVES:

Upon the completion of this course, the student will be able to know basic knowledge and skill on principles and practices of irrigation and drainage, crop water requirement, consumptive use, soil-water-plant relationship, irrigation scheduling, irrigations methods, reclamation of water-logged field, drainage systems, existing farmers' managed irrigation and drainage technologies in Nepal.

I. SYLLABUS:

Introduction to irrigation water resources in Nepal, prevailing irrigation and drainage systems, perspective of irrigation development, irrigation water management; Environmental impacts of irrigation water use, Soil-Water-Plant Relationship; Soil moisture constants, Infiltration, intake, percolation, seepage, permeability, hydraulic conductivity; Soil moisture extraction pattern and critical stages of crops; Evaporation, transpiration, Evapotranspiration (ET), consumptive use; potential evapotranspiration, crop coefficient, Crop water requirements, Irrigation efficiency, irrigation water requirement, Duty of water and Delta; Irrigation water scheduling, depth and frequency of irrigation, deficit irrigation, allowance soil moisture depletion, Soil, plant and climatic indicators for irrigation scheduling, Crop planning; Farm irrigation methods: Surface irrigation method, Sub-surface irrigation method, Overhead: Sprinkler irrigation method, others methods: drip and trickle irrigation method, Advanced technologies in irrigation methods, Performances of irrigation methods; Canals: open channel, Measurement of irrigation water: weir, flumes and orifices, float method; Water control structures, erosion control structures, channel crossing structures, Irrigation pumps: Types of Irrigation pumps: Displacement pumps, Centrifugal pumps, turbine pumps, propeller pumps, airlift pumps, Selection of irrigation pumps; performance of Centrifugal pump, characteristic curves, affinity laws, specific speed; Drainage Engineering: water logging and its effects, Causes of water logging, Land drainage, classification of drains, benefits of drainage, essential requirement of drains, surface drains and closed drains, Land reclamation: saline, alkali soils, saline-alkali soils; formation of saline, alkali soils; farmers' managed irrigation system in Nepal.

II. COURSE OUTLINE

A.Lecture

S. N.	Topics	No. of Lectures
1.	Introduction: Concept of irrigation and drainage water management, objectives, advantages and disadvantages; Introduction to irrigation water resources in Nepal, prevailing irrigation and drainage systems, perspective of irrigation development, Environmental impacts of irrigation water use,	2
2.	Farmers managed irrigation system in Nepal: Introduction to farmers' managed traditional water management system; Introduction to locally available terminologies and methods related to irrigation and drainage water management	1
3.	Soil-Water-Plant Relationship: Classes of soil water; apparent specific gravity; Soil moisture constants; Soil moisture extraction pattern and critical stages of crops for soil moisture; Depth of soil moisture available to plants, Infiltration, Intake, percolation and deep percolation, seepage, permeability, hydraulic conductivity.	3
4.	Potential Evapotranspiration (PET): Concept of evaporation, transpiration, evapotranspiration, consumptive use, potential evapotranspiration, crop coefficient, crop water requirements, Seasonal ET, Actual ET; Estimation of ET by field method (Lysimeters, Evapometers) and empirical method (modified Penman method, Blaney and Criddle method, Christiansen method); Effective rainfall, crop period and base period, command areas and intensity of irrigation, paleo irrigation, kor watering;	3
5.	Water requirements of crops: Determination of crop water requirement- Transpiration ratio method, depth-interval-yield method, soil moisture depletion method; climatological method, field experiment method and drum culture technique for rice; Irrigation water requirement (NIR, FIR, GIR); Duty of water and Delta: and their relations. Factors affecting duty of water	3
6.	Irrigation scheduling: Objectives and strategies of irrigation scheduling, Function of irrigation water, limiting soil moisture conditions; Depth and frequency of irrigation; deficit irrigation; allowance soil moisture depletion; Soil, plant and climatic indicators for irrigation scheduling; Crop planning (continuous, rotational and demand based); Farmers' present practices of irrigation water scheduling.	3

7.	Farm irrigation methods: Surface irrigation method: check basin, border strip, contour lateral, ring basin, furrow, corrugation; Sub-surface irrigation method; Overhead irrigation method- Sprinkler irrigation method; Others irrigation methods; drip, trickle irrigation methods; Performances of irrigation methods- efficiencies, application uniformity, adequacy and effectiveness of irrigation.	5
8.	Open channel and measurement of irrigation water: Introduction to an open channel and solve numerical; Measurement of irrigation water: Float method, current meter, weir, orifices; Parshall flume and Cutthroat flume	3
9.	Canal structures: Water control structures: check gates, turnouts, siphons, division boxes; Erosion control structures open drop structures and pipe drop structures; channel crossing structures- Aqueduct, inverted siphon, culverts.	2
10.	Irrigation pumps: Types of Irrigation pumps: displacement pumps (hand pumps), Centrifugal pumps, turbine pumps, propeller pumps, airlift pumps; Selection of irrigation pumps; performance of centrifugal pump, characteristic curves, affinity laws, specific speed.	2
11.	Drainage System: Introduction; water logging and its effects, Causes of water logging; Land drainage, classification of drains, benefits of drainage; essential requirement of drains; surface drains and closed drains; Land reclamation-definition; saline, alkali soils, saline-alkali soils; formation of saline, alkali soils.	3
Total		30

B. practical

S. N.	Topic	No. of Practicals
1.	Measurement of soil moisture by using: Gravimetric method; Tensiometer; Feel and appearance method; Soil moisture meter	2
2.	Determination of soil moisture constants: Saturation Capacity (SC), Field capacity (FC); Permanent wilting point (PWP), Ultimate wilting (UW)	2
3.	Measurement of infiltration rate of soil: Use of double ring infiltrometer, Single ring infiltrometer; Use of A.N. Kostiakov's formula and determination of its characteristic constants.	2
4.	Determination of evapo-transpiration by using climatic data: Use of Penman's method; Use of Blaney-Criddle method; Using USWB class A pan evapometer, lysimeter	3
5.	Study of different farm irrigation methods: Furrow method, check basin, Sprinkler; Drip irrigation and advanced techniques of irrigation, if any	2
6.	Assessment of field water losses, seepage, percolation and runoff	1
7.	Measurement of flow of water in an open channel by using: Float method; Flow measuring devices: weirs, Parshall flume, cutthroat flume and orifices	2
8.	Field visit to irrigation and drainage systems	1
Total		15

REFERENCES

A.M. Michael. 1997. Irrigation Theory and Practice. Vikas Publishing house Pvt. Ltd. New Delhi.

B.C. Punmia and B.B. Pande. 1990. Irrigation and water Power Engineering. XI Ed. Standard Publishers Distribution, Delhi.

G.N. Shankara Reddi and T. Yellamanda Reddy. 1995. Efficient Use of Irrigation Water. Kalyani Publishers, New Delhi.

P.N. Modi. 2000. Irrigation Water Resources and Water Power Engineering. IV ed, Standard book house, Delhi.

R.K. Sharma and T.K. Sharma. 2002. Irrigation Engineering. S. Chand and Company ltd, New Delhi.