I. Course Title : Soil-Water-Plant-Atmospheric Modeling

II. Course Code : IDE 604

III. Credit Hours : 2+1

IV. Aim of the course

To impart the knowledge of measurement of radiation within plant cover, thermodynamics of flow through plant cells, heat transfer and radiation exchange under plant cover.

V. Theory

Unit I

Radiation balance of earth's surface. Turbulent transport of heat and momentum. Radiation exchange and heat transfer in a low plant cover.

Unit II

Measurement of radiation, leaf and air temperature, humidity and wind profiles within plant cover. Predicting potential evapotranspiration.

Unit III

Thermodynamics of flow through plant cells. Dynamics of water movement through soil plant atmosphere system. Stomatal aperture, photosynthesis and actual evapotranspiration relationship.

Unit IV

Production functions of evapotranspiration. Evapo-transpiration in mathematical modelling and optimization of design and regulation of irrigation systems and for utilization of limited water resources in agriculture.

Unit V

Crop water requirement under protected cultivation and remote sensing-based modeling.

VI. Practical

Estimation of potential evapotranspiration. Measurement of ET parameters under open and protected cultivation and development of stochastic and deterministic models of ET. Use of software for estimation of crop water requirement and ET.

VII. Learning outcome

The students will be able to understand the measurement of radiation, photosynthesis and actual evapotranspiration relationship along with modeling of evapotranspiration.

VIII. Lecture Schedule

S.No.	Topic	No. of Lectures
1.	Radiation balance of earth's surface	1
2.	Turbulent transport of heat and momentum	2
3.	Radiation exchange and heat transfer in a low plant cover	2
4.	Measurement of radiation, leaf and air temperature, humidity and wind profiles within plant cover	2
5.	Predicting potential evapotranspiration	2
6.	Thermodynamics of flow through plant cells	2
7.	Dynamics of water movement through soil plant atmosphere system	2

S.No.	Topic	No. of Lectures
8.	Stomatal aperture, photosynthesis and actual evapotranspiration relationship	1
9.	Production functions of evapotranspiration	3
10.	Evapo-transpiration in mathematical modelling and optimization of design and regulation of irrigation systems and for utilization of limited water resources in agriculture	4
11.	Crop water requirement under protected cultivation and remote sensing-based modeling	4
	Total	**29**

IX. List of Practicals

S.No.	Topic	No. of Practicals
1.	Estimation of potential evapotranspiration using FAO 56 Penman Monteith equation	1
2.	Estimation of potential evapotranspiration using FAO Cropwat model	1
3.	Estimation of potential evapotranspiration using FAO ETo calculator	2
4.	Measurement of ET parameters under open condition	1
5.	Measurement of ET parameters under protected cultivation	1
6.	Development of stochastic models of ET	3
7.	Development of deterministic models of ET	3
8.	Use of software for estimation of crop water requirement and ET	2
	Total	**14**

X. Suggested Reading

- Amarjit Basra. 1994. *Mechanisms of Plant Growth and Improved Productivity*. CRC Press New York.
- Daniel Hillel. *Advances in Irrigation*. All Volumes.
- Nieder AR and Benbi D. 2003. *Handbook of Processes and Modeling in the Soil-Plant System*. CRC Press New York.
- Peter J Gregory. *Plant Roots, their Growth Activity and Interaction with Soils.* Wiley Blackwell New York.

I. Course Title : Plant Growth Modeling and Simulation

II. Course Code : IDE 605

III. Credit Hours : 2+0

IV. Aim of the course

To impart the in-depth knowledge of plant growth modeling, type of modeling approach, quantitative analysis of photosynthesis and remote sensing-based modeling.

V. Theory

Unit I

Introduction to plant growth modeling. Simulation and simulation language. Types of models and modeling approaches.

Unit II

Relational diagram of principle process. Structure of a generalized agricultural simulator. Input environment and techniques for monitoring plant environment.