Unit III

Process and aspects of growth and development. Input yield models. Quantitative analysis of photosynthesis, respiration, growth, water and nutrient uptake. Yield functions.

Unit IV

Remote sensing-based modeling and field variability of growth influencing factors.

VI. Learning outcome

The students will be able to know various plant growth models and their application based on input environmental parameters. Student will be acquainted with generalized agricultural simulator.

VIII. Lecture Schedule

S.No.	Topic	No. of Lectures
1.	Introduction to plant growth modelling	4
2.	Simulation and simulation language	4
3.	Types of models and modeling approaches	4
4.	Relational diagram of principle process	2
5.	Structure of a generalized agricultural simulator	2
6.	Input environment and techniques for monitoring plant environment	4
7.	Process and aspects of growth and development. Input yield models	4
8.	Quantitative analysis of photosynthesis, respiration, growth, water and nutrient uptake. Yield functions	3
9.	Remote sensing-based modelling	3
10.	Field variability of growth influencing factors	2
	Total	**32**

IX. Suggested Reading

- Charls-Edwards DA. 1981. *The Mathematics of Photosynthesis and Productivity*. Academic Press, London.
- Evans LT. 1963. *Environmental Control of Plant Growth*. Academic Press, New York, USA.
- Goudriaan J and Van Laar HH. 1994. *Modelling Potential Crop Growth Process*. Kluweer Academic Publisher, Dordrecht, The Netherlands.
- Jones JW and Ritchie JT. 1990. *Crop Growth Models*. In: ASAE Monograph on Management of Farm Irrigation.
- Thorwey JHM and Johnson IR. 1990. *Plant and Crop Modelling: A Mathematical Approach to Plant and Crop Physiology*. Clarendon Press, Oxford.

I. Course Title : Multi Criteria Decision Making Systems

II. Course Code : IDE 606

III. Credit Hours : 2+0

IV. Aim of the course

To acquaint students about multi criteria decision making system which include multi-attribute decision making and multi-objective decision making.

V. Theory

Unit I

Introduction: MCDM overview, basic foundations and Pareto optimality elementary decision analysis. Decision trees and influence diagrams.

Unit II

Multi–attribute decision making (MADM): Deterministic utility theory, value decomposition, additive value decomposition, Multi–facility location analysis, expected utility theory, single attribute utility functions, multi–attribute overview, two–attribute utility models, multi–attribute computer programs, multi–attribute assessment.

Unit III

Multi-objective decision making (MODM): Vector optimization theory, weighting methods, weighting example. Linear vector optimization (LVOP), parametric decomposition, LVOP algorithm, LVOP example.

Unit IV

Non interactive and interactive methods: Geoffrion's Bi-criterion method, linear goal programming, nonlinear and integer goal programming.

Unit V

Interactive trade-off methods: Zionts–Wallenius, Surrogate worth, Group decision making methods.

VI. Learning outcome

The students will be able to understand and learn to apply various techniques for the best solutions of real-life command area and other hydrological problems.

VII. Lecture Schedule

S.No.	Topic	No. of Lectures
1.	MCDM overview	1
2.	Basic foundations and Pareto optimality elementary decision analysis	2
3.	Decision trees and influence diagrams	1
4.	Multi-attribute decision making (MADM): Deterministic utility theory, value decomposition, additive value decomposition	2
5.	Multi-facility location analysis	1
6.	Expected utility theory	1
7.	Single attribute utility functions	1
8.	Multi-attribute overview	1
9.	Two-attribute utility models	1
10.	Multi-attribute computer programs and multi–attribute assessment	2
11.	Multi-objective decision making (MODM)	1
12.	Vector optimization theory	1
13.	Weighting methods and examples related with weighting	2
14.	Linear vector optimization (LVOP)	1
15.	Parametric decomposition	2
16.	LVOP algorithm and LVOP example	2
17.	Non interactive and interactive methods	2
18.	Geoffrion's Bi-criterion method	1
19.	linear goal programming, nonlinear and integer goal programming	2
20.	Interactive trade-off methods	1
21.	Zionts-Wallenius and Surrogate worth	2
22.	Group decision making methods	2
	Total	**32**

VIII. Suggested Reading

- Cohon JL. 2004. *Multiobjective Programming and Planning*. Dover Publications.
- Doumpos M and Grigoroudis E. 2013. *Multicriteria Decision Aid and Artificial Intelligence: Links, Theory and Applications*. Wiley-Blackwell.
- Figueira J, Greco S and Ehrgott M 2007. *Multiple Criteria Decision Analysis: State of the Art Surveys*. Springer.
- Tzeng GH and Huang JJ. 2011. *Multiple Attribute Decision Making: Methods and Applications*. Chapman and Hall/CRC.
- Tzeng GH and Huang JJ. 2013. *Fuzzy Multiple Objective Decision Making*. Chapman and Hall/CRC.