The Hebrew University of Jerusalem

Syllabus

CLIMATE CONTROL IN GREEN HOUSES - 71604

Last update 09-03-2025

HU Credits: 2

Degree/Cycle: 1st degree (Bachelor)

Responsible Department: Soil and Water Sciences

Academic year: 0

Semester: 2nd Semester

Teaching Languages: Hebrew

Campus: Rehovot

Course/Module Coordinator: Dr. Meir Teitel

Coordinator Email: meir.teitel@mail.huji.ac.il

Coordinator Office Hours: By appointment

Teaching Staff:

Dr. Meir Teitel

Course/Module description:

Students will learn the basic principles of greenhouse microclimate management and control. Information on current greenhouse structures and crops grown in greenhouses will be provided. In the first part of the course the students will be introduced to principles of heat transfer, fluid mechanics and psychrometrics. The second part will deal with greenhouse heating, ventilation, cooling, shading, CO2 enrichment, sensors for climate control and basic control and management strategies.

Course/Module aims:

The course aims to provide students with a comprehensive understanding of greenhouse structures and their types, specifically focusing on those in Israel and globally. It will cover the essential processes involved in greenhouse climate management, exploring various systems and their operational mechanisms. Additionally, students will engage in basic calculations related to climate management and learn fundamental concepts in control processes to effectively manage greenhouse environments.

Learning outcomes - On successful completion of this module, students should be able to:

On successful completion of this module, students should be able to:
•define and characterize climate management processes and ways of dealing with problems in greenhouses. You will be able to move from a qualitative description of the problem to a quantitative solution. You will practice quantitative thinking. You will know how to define the systems needed for greenhouse climate management and perform basic calculations required in the design of the above systems.

Attendance requirements(%):

75%

Teaching arrangement and method of instruction: Theoretical lectures based on powerpoint presentations and exercises.

Course/Module Content:

Lectures 1, 2 - Background -general terms and overview of climate management systems in greenhouses: heating, carbon dioxide enrichment (CO2), ventilation, cooling, shading, sensors for climate control.

Lectures 3, 4, 5 - Principles of heat transfer: conduction, convection and radiation, solar radiation, flow principles.

Lecture 6 - greenhouse heating systems: hot water and hot air.

Lecture 7 - psychrometerics and characteristics of humid air.

Lecture 8, 9 - Ventilation and cooling processes: natural and forced ventilation, use of nets against insects, cooling by fan and pad and mist systems .

Lecture 10 - climate controlled greenhouses tour (according to the circumstances).

Lecture 11 - principles of measurement of climatic parameters in greenhousesת CO2 enrichment calculation (optional).

Lectures 12, 13 - Photovoltaic greenhouses, artificial lighting, Plant factory.

Lecture 13, 14 - Basic Concepts of control, block diagrams, the reactions of processes and components in monitoring, first-order dynamic analysis of physical processes, implementation of control systems in greenhouses.

Required Reading:
None

Additional Reading Material:

1) Greenhouse climate control: an integrated approach. 1995. Eds. J. C. Bakker, G.P.A. Bot, H. Challa and N.J. Van de Braak. Wageningen Press.
2) Computerized environmental control in greenhouses: a step by step approach. 1996. P.G.H. Kamp and G.J. Timmerman. IPC plant, Ede, The Netherlands.
3) Greenhouses, advanced technology for protected horticulture. 1998. J.J. Hanan. CRC Press.
4) Integrated greenhouse systems for mild climates. 2011. C. von Zabeltitz, Springer.
5) Greenhouse Technology and Management, 2nd Edition. 2013. Nicolás Castilla. CABI, UK.
6) Plant Factory, An Indoor Vertical Farming System for Efficient Quality Food Production. Editors: Toyoki Kozai, Genhua Niu, Michiko Takagaki, 2nd Edition - November 3, 2019, eBook ISBN: 9780128166925
7) Greenhouse management: A guide to operations and technology. Ted Goldammer, 2019 Apex Publishers.

Grading Scheme:

Additional information:

The Quiz is a protective grade.
At the end of the semester, each pair of students will be given a summary exercise sheet to be solved at home. The students will submit the solution and be tested on it orally. It may be that instead of a summary exercise there will be a written exam. Details will be given at the beginning of the semester.