האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

The Hebrew University of Jerusalem

Syllabus

REMOTE SENSING OF SOIL-PLANT-ATMOSPHERE PROCESSES - 71631

Last update 07-05-2024

HU Credits: *3*

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 David Helman*

Coordinator Email: *david.helman@mail.huji.ac.il*

Coordinator Office Hours: *TBD*

Teaching Staff:
Dr. David Helman,
Mr. yehuda toungshtein

Course/Module description:
The course describes remote sensing methods for monitoring and modeling biophysical processes related to the soil-plant-atmosphere continuum, such as evapotranspiration, fluxes, and soil water dynamics, in agricultural and natural vegetation systems. The course implements mathematical and physical calculations and practical exercises in Phyton. The course is divided into three parts: (1) a theoretical basis in which we'll learn the principles of electromagnetic radiation, black body, energy balance, and radiative transfer; (2) Physical methods to assess fluxes and ET; (3) empirical and semi-empirical methods to derive ET and soil water content from satellite data.

Course/Module aims:
The course aims to provide the students with a basic knowledge of remote sensing of biophysical processes related to the soil-plant-atmosphere continuum in agricultural and natural vegetation systems. Students will learn the theoretical basis behind remote sensing and the connection to energy balances and fluxes. The course will incorporate lectures, computational exercises, and practice in Python programming language, where we will practice the use of data acquired from satellites to model fluxes, ET, and SWC.

Learning outcomes - On successful completion of this module, students should be able to:
On successful completion of this module, students should be able to:
- *Understand the principles of remote sensing of biophysical processes*
- *Know the main methods of remote sensing of biophysical processes*
- *Download and analyze satellite images*
- *Use remote sensing data for basic assessment of ET and fluxes in a crop field*

Attendance requirements(%):
100%

Teaching arrangement and method of instruction: Frontal lecture, reading of required materials, exercises sessions in a computer lab

Course/Module Content:

1. Electromagnetic radiation & black body radiation
2. Data cube (3-D), N-D data & atmos. absorbance
3. Atmospheric windows (cont.)
4. Atmospheric correction (SST)
5. Earth's energy components (Energy Balance A)
6. Sensible heat flux – H (Energy Balance B)
7. Soil heat flux – G & Closing the balance (Ene. Bal. C)
8. Spectral Indices on GEE (time series) [mid-term exam]
9. The Trapezoid method
10. RS-based FAO-56 (replacing kc with VIs)
11-13. Final Project

Required Reading:
Reading material will be part of the home assignment.

Additional Reading Material:
Hanes, J.M. (Ed.). (2013). Biophysical applications of satellite remote sensing. Springer Science & Business Media.
Jensen, J.R. (2007). Remote Sensing of the Environment: An Earth Resource Perspective, 2nd Ed., Upper Saddle River, NJ: Prentice Hall, 592 pages.
Hendriks, M. (2010). Introduction to physical hydrology. Oxford University Press.
van der Tol, C. & Parodi, G.N. (2012). Guidelines for remote sensing of evapotranspiration (pp. 227-250) in Evapotranspiration: Remote Sensing and Modeling. InTech.

Grading Scheme:
Essay / Project / Final Assignment / Home Exam / Referat 50 %
Submission assignments during the semester: Exercises / Essays / Audits / Reports / Forum / Simulation / others 30 %
Mid-terms exams 20 %

Additional information:
The course implements mathematical and physical calculations and is open to students that successfully completed the course of Basic Python programing (71137).
The course is limited to a maximum of 35 students; therefore, students with previous knowledge in agricultural meteorology, particularly those that successfully completed the course FUNDAMENTALS OF AGRICULTURAL METEOROLOGY (71619), will be prioritized. Students without prior knowledge in agricultural meteorology should consult the instructor prior to registration.