האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

The Hebrew University of Jerusalem

Syllabus

Mathematical Introduction for Chemistry and Earth Sciences students (2) - 80112

Last update 06-04-2020

HU Credits: *6*

Degree/Cycle: *1st degree (Bachelor)*

Responsible Department: *Mathematics*

Academic year: *0*

Semester: *2nd Semester*

Teaching Languages: *Hebrew*

Campus: *E. Safra*

Course/Module Coordinator: *Dr. Eli Kraisler*

Coordinator Email: *eli.kraisler@mail.huji.ac.il*

Coordinator Office Hours: *By appointment*

Teaching Staff:
Dr.
Mr. Shlomo Eshel
Mr. Itay Schachter

Course/Module description:
Many-variable calculus, vector analysis and ordinary differential equations

Course/Module aims:
To provide the students with the mathematical tools they need in studying courses in chemistry and physics

Learning outcomes - On successful completion of this module, students should be able to:
The students have to be familiar with the main mathematical concepts and methods in many-variable calculus, vector analysis and ordinary differential equations and be able to apply them to problems in chemistry.

Attendance requirements(%):
Attendance is not compulsory, but it is expected and highly recommended.

Teaching arrangement and method of instruction: Lectures and tutorials

Course/Module Content:
1. Overview: vectors – addition, subtraction, scalar and vector products.
2. Many-variable function: partial derivatives, directional derivative. Examples in chemistry.
3. Vector and scalar fields. Derivatives of vectors. Gradient. Examples in physics and chemistry.
4. The operator nabla. Divergence, curl and laplacian. Examples.
5. Analysis of a many-variable function: minima, maxima, saddle points. Constraints and Lagrange multipliers.
6. Integral of a many-variable function. Change of variables, Jacobian. Examples and applications.
7. Line integrals, conserving fields. Surface integrals. Flux.
8. Green, Gauss and Stokes theorems.
9. Spherical and cylindrical coordinates. Gradient, divergence and Laplacian in these coordiantes.
10. Ordinary differential equations (ODEs). Types and common examples in

chemistry and physics.
11. First order ODEs. Selected solution methods. Initial conditions.
12. Second order ODEs. Solution independence. Homogeneous and inhomogeneous ODEs.

Required Reading:
There are no mandatory reading assignments.

Additional Reading Material:
M.L. Boas, Mathematical Methods in the Physical Sciences
M. R. Spiegel, Vector analysis
F. Ayres, Differential Equations
M.R. Spiegel, Applied Differential Equations
W. Boyce, R.C. DiPrima, Elementary Differential Equations
G. Arfken, Mathematical Methods for Physicists
K. F. Riley, M. P. Hobson, S.J. Bence,
Mathematical Methods for Physics and Engineering

Course/Module evaluation:
End of year written/oral examination 80 %
Presentation 0 %
Participation in Tutorials 0 %
Project work 0 %
Assignments 20 %
Reports 0 %
Research project 0 %
Quizzes 0 %
Other 0 %

Additional information:
Submission of 70% of the tutorial handouts is compulsory.
The grade in the midterm exam can serve as a 'protective grade', namely it can only improve the final grade. If such, the final grade will be composed of: 20% midterm grade, 20% exercises, 60% final exam.

Update for year 2020 due to the Coronavirus pandemic:
1. In case the midterm exam will not take place, the final grade will be composed of: 80% final exam, 20% exercises.
2. In case we will not be able to hole the final exam or the midterm exam in the usual way, in class, the Course Team will consider to hole the exam remotely using the best technology available at the moment.