האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

The Hebrew University of Jerusalem

Syllabus

Chemistry and Physics of advanced medical imaging and research imaging - 69920

Last update 24-02-2019

HU Credits: 2

Degree/Cycle: 2nd degree (Master)

Responsible Department: Chemistry

Academic year: 0

Semester: 2nd Semester

Teaching Languages: Hebrew

Campus: E. Safra

Course/Module Coordinator: Prof. Rachel Katz-Brull

Coordinator Email: rkb@hadassah.org.il

Coordinator Office Hours:

Teaching Staff:
Prof Rachel Katz-Brull

Course/Module description:
The course will describe how chemistry and physics are utilized in current medical imaging in clinical and research use, emphasizing the various methodologies and their applications

Course/Module aims:
The aims of this course are 1) to expose the students to the variety of methods and technologies which exist today for non-invasive imaging of the body and brain; 2) To learn about the multiple cellular and tissue characteristics that can be monitored and quantified by non-invasive imaging; 3) To stimulate thinking towards various future developments in the field of bio-medical imaging.

Learning outcomes - On successful completion of this module, students should be able to:
To recognize the various medical imaging technologies and their applications

Attendance requirements(%):
None

Teaching arrangement and method of instruction: Frontal lectures

Course/Module Content:
1. Introduction to medical imaging with emphasis on MRI
2. Contrast agents used in medicine, directions in future contrast agents development
3. Molecular Imaging Probes, Molecular Imaging, MRI, PET, SPECT
4. Contrast mechanisms in medical imaging by MRI: FLAIR, T1, T2
Contrast generation on X-ray imaging, fluoroscopy, CT, UltraSound (US), Echo, Elastography, spectral CT
5. Functional MRI in use in brain function research, contrast mechanism by blood oxygenation level – BOLD
6. Brain imaging in neurodegenerative diseases. Spectroscopy of the brain - MRS
7. Body imaging – imaging of the fat/water ratio in fatty liver. Phase contrast imaging, US – examples.
8. Imaging of cancer tumors, characterization of tissues by imaging, Dynamic Contrast Enhancement MRI (DCE-MRI). X-ray imaging and fluoroscopy - examples.

9. Physical principles of MRI, read and phase encoding, artifacts
10. Spin echo and gradient echo sequences
11. Fast imaging, current approaches and research approaches, diffusion as a contrast mechanism, diffusion weighted imaging (DWI), Diffusion tensor imaging (DTI), imaging of neuronal tracts by DTI
12. Hyperpolarized MRI molecular imaging, multinuclei spectroscopy
13. Molecular imaging by Positron Emission Tomography (PET)
14. Pathologic metabolic pathways and the means to observe them non-invasively by hyperpolarize MRI and PET

Required Reading:
None

Additional Reading Material:
Will be given when the course starts

Course/Module evaluation:
End of year written/oral examination 100 %
Presentation 0 %
Participation in Tutorials 0 %
Project work 0 %
Assignments 0 %
Reports 0 %
Research project 0 %
Quizzes 0 %
Other 0 %

Additional information:
Open examination.
Some of the classes will be given in the format of Active learning units.