

Biomedical Photonics.

Syllabus

1. Introduction

2. Effects of Tissue on light: Diagnostic

2.1 Tissue optics: absorption, scattering, photon transport theory, models etc.

2.2 Diagnostic techniques

2.2.1 Optical Coherent Tomography (OCT)

2.2.2 Reflectance and fluorescence spectroscopy

2.2.3 Raman spectroscopy

2.2.3 Pulsioximeter and vein-viewer

2.2.4 Optical diffuse Tomography

2.2.5 Photoacoustic imaging

2.2.6 Novel diagnostic techniques

2.3 Simulations.

3. Effects of absorbed Light on tissue: Laser therapy

3.1 Photothermal effects. Application to surgery and dermatology

3.2 Ablation. Application to refractive surgery

3.3 Photomechanical effects. Application to ophthalmology

3.4 Photochemical effects: Photodynamic therapy. Application in cancer and dermatology

4. Optical Microscopy

4.1 Basic set up: Bright field

4.2 Increase of the contrast by optical techniques: Oblique illumination, Dark field, Phase contrast, Differential interference contrast and Interference reflection microscopy

4.3 Fluorescence microscopy:

4.4 3D imaging: Laser scanning Confocal, multiphoton, light sheet microscopy.

Evaluation

Weekly questionnaire: 25%

3 Exams (therapy, diagnosis, microscopy): 60% (20% each)

Presentation of a journal paper: 15%

Bibliography

P. N. Prasad, "Introduction to biophotonics", John Wiley & Sons, Inc., New Jersey, 2003.

Markolf H. Niemz, "Laser-Tissue Interactions", Springer, Berlin, 2007.