

Exam of the course

“Biomedical Applications of Mathematics”

The student has to choose **one** of the three parts of the course, and do what is there requested.

★ First part: **Roberto Bonmassari, Eleuterio F. Toro and Lucas O. Müller**
The procedures for the exam have to be requested to Prof. Toro

★ Second part: **Paolo Manganotti, Emanuela Formaggio, Silvia F. Storti**
The exam consists in a computer slide presentation of one of the following topics (time: 30/40 minutes):

- multimodal analysis (EEG, HD EEG, fMRI) for study of the epilepsy
Related papers:
 - Baillet et al., Electromagnetic brain mapping, *IEEE Signal Processing Magazine*, 18 (2001), 14–30
 - Wolters et al., Numerical mathematics of the subtraction method for the modeling of a current dipole in EEG source reconstruction using finite element head models, *SIAM J. Sci. Comput.*, 30 (2007), 24–45
- brain stimulation and multimodal analysis
Related papers:
 - Heller and van Hulsteyn, Brain stimulation using electromagnetic sources: theoretical aspects, *Biophys. J.*, 63 (1992), 129–138
 - Sekino et al., Intensity and localization of eddy currents in Transcranial Magnetic Stimulation to the cerebellum, *IEEE Trans. Magn.*, 42 (2006), 3575–3577
- digital analysis in EEG
Related papers:
 - Thakor and Tong, Advances in quantitative electroencephalogram analysis methods, *Annu. Rev. Biomed. Eng.*, 6 (2004), 453–495

The quoted papers have to be requested to Prof. Valli

★ Third part: **Nivedita Agarwal**

The exam consists in a computer slide presentation of one of the following topics (time: 30/40 minutes):

- Diffusion Tensor Imaging (DTI): theoretical basis for the study of water molecules diffusion in the brain tissue
Related papers:
 - Basser et al., Estimation of the effective self-diffusion tensor from the NMR spin echo, *J. Magnetic Resonance (Series B)*, 103 (1994), 247–254
 - Basser et al., Diffusion-tensor MRI: theory, experimental design and data analysis. A technical review, *NMR in Biomedicine*, 15 (2002), 456–467

- Mori et al., Fiber tracking: principles and strategies. A technical review, *NMR in Biomedicine*, 15 (2002), 468–480
- Westin et al., Processing and visualization for diffusion tensor MRI, *Medical Image Analysis*, 6 (2002), 93–108
- Functional MRI (fMRI): mapping the brain activity by means of magnetic resonance. From the basis to data analysis
Related papers:
 - Ogawa et al., Functional brain mapping by blood oxygenation level-dependent contrast magnetic resonance imaging. A comparison of signal characteristics with a biophysical model, *Biophys. J.*, 64 (1993), 803–812
 - Friston et al., Analysis of functional MRI time-series, *Human Brain Mapping*, 1 (1994), 153–171
 - Friston et al., Statistical parametric maps in functional imaging: a general linear approach, *Human Brain Mapping*, 2 (1995), 189–210
- Functional connectivity MRI (fCMRI): methods to analyze brain functional connectivity using fMRI
Related papers:
 - Lowe et al., Functional connectivity in single and multislice echoplanar imaging using resting state fluctuations, *Neuroimage*, 7 (1998), 119–132
 - Li et al., Review of methods for functional brain connectivity detection using fMRI, *Comput. Med. Imaging Graph*, 33 (2009), 131–139

The quoted papers have to be requested to Prof. Valli