Basic of light microscopy:

1. Absorption scattering of light.
2. Objective lenses.
3. Objective resolution magnification working distance.
4. Transmitted light microscopy: bright field, phase contrast DIC, dark field, Holo-tomography.
5. Microscope types: inverted, upright.
6. Basics of fluorescence.
7. Fluorescence filters, fluorescence detection.
8. Basic of detections.
9. Fluorescence and resolution.
10. Wide field fluorescence imaging.
11. Detectors for wide field scanning.
12. Point scan fluorescence imaging.
13. Detectors for point like scanning.
14. Spectral detectors.
15. Interpretation of an image produced by a light microscope.
16. Concept of point spread function.
17. Confocal microscopy.
18. Spinning disk microscopy.

Advanced confocal microscopy:

1. Considerations regarding the system PSF.
2. Measuring the PSF of a light microscope.
3. Main parameter influencing PSF.
4. Multicolor microscopy.
5. Multicolor microscopy and sequential scanning.
6. Multicolor microscopy and spectral unmixing.

Microscopy on the single molecule level:

1. FRET.
2. FRAP.
3. FCS.
4. FCCS.
5. FLIM.
6. FLIM unmixing.
7. FRET-FLIM.

Non linear microscopy:

1. Multi-photon microscopy.
2. SHG microscopy.
3. Application of MP and SHG microscopy.
4. MP-FRAP.
5. Multi-Photon FLIM.
6. Tri-Exciton microscopy.
7. Polarization microscopy.

Raman microscopy and spectroscopy

Non linear microscopy part 2:

1. CARS microscopy.

Polarization microscopy and its application in nanotechnology and biology:

1. Synthesis of Not-isotropic polarized beams.
2. Basic theory or radial and azimuthally polarized beams.
3. Single molecule and single nanoparticle detection.
4. Needle beam microscopy and application in biology.
5. SGH microscopy with not isotropic polarization.
6. Reflection microscopy.
7. Metal nanoparticles microscopy.
8. Application of metal nanoparticles imaging in nano-technology.
9. Application of metal nanoparticles imaging in bio-imaging.
10. Luminescence imaging of metal nanoparticles.

Microscopy and deconvolution:

1. The concept of PSF.
2. Parameters determining the microscope PSF.
3. Experimental PSFs of different microscopes.
4. Deconvolution concept.
5. Practical example of deconvolution.
6. Problems related to deconvolution.
7. Deconvolution methods.
8. Deconvolution with theoretical PSFs.
9. Deconvolution with experimental PSFs.
10. Measuring the PSF.
11. Imaging and deconvolution examples.

The concept of multidimensional microscopy.

Imaging Macroscopic samples:

1. Live embryo.
2. Different approaches in light sheet microscopy.
3. Mesolenses.

Live cell imaging:

1. Basic live cell imaging experiments..
2. Spinning disk microscopy
3. Spinning disk-TIRF.
4. Live FRET.
5. Holotomography.
6. Live Embryo.

Imaging living samples:

1. Basic live cell experiments.
2. Spinning disk microscopy and live cell imaging.
3. Advanced live cell imaging experiment.
4. Experiment with macroscopic living samples.

Soft super resolution microscopy:

1. Confocal microscopy with closed pin-hole.
2. Linear SIM deconvolution.
3. Image scan microscopy (Airy scan, SoRa etc.etc.).
4. SRRF.
5. Microscopy with needle beam.
6. Needle beam microscopy plus Image Scan Microscopy.

Soft super resolution microscopy:

1. Non Linear SIM.
2. STED/RESOLFT Microscopy.
3. Wide Field SMLM .
4. SOFI.

Hard super resolution microscopy:

1. Near Field microscopy.
2. MINFLUX microscopy.
3. MINSTED microscopy.
4. SIMFLUX microscopy.
5. MINFLUX application at UKE.
6. MINFLUX tracking at UKE.

Scanning Electrom Microscopy (SEM).

Transmission Electron microscopy (TEM).

Volume Electron microscopy.

Basic of Sample preparation.

Advanced sample preparation.

Super resolution and sample preparation.

Basic and advanced image analysis approaches:

1. What is an image.
2. Operation with Images.
3. Intensity based quantification.
4. Tracking quantification.
5. Photo-activation bleaching methods.

Basic and advanced image analysis approaches:

1. Quantification with deconvolution.
2. FRET.
3. Spectral un-mixing.
4. FRET and Spectral un-mixing.
5. FRET-FLIM.
6. Cluster analysis and minumum distance.