

Additional Questions to the Lectures

Optical Metrology and Sensing (WS 2015/2016)

1. What is the meaning of a material measure or standard? Give some examples for it!
2. Describe the Abbe comparator principle!
3. What is the meaning of the „confidence interval“ of measured values?
4. Explain the meaning of scanning/sensing a test piece, primary and secondary standards, systematic and random errors, uncertainty of measurement!
5. Describe the difference between “accurate/correct” and “precise”!
6. Explain the measurement terms reproducibility and repeatability!
7. What is the meaning of the sensibility and resolution of an instrument?
8. What has influenced the uncertainty of measurement of the primary standard of length?
9. What is the meaning of spatial and temporal coherence?
10. How can the coherence time and the coherence length be measured?
11. How can the spatial coherence be measured?
12. Which kinds of interference structures are generated if two plane waves, two spherical waves or a plane wave and a spherical wave are superposed?
13. What is the visibility of fringes and how can it be determined?
14. What does the degree of coherence describe and how does it influence the law of interference?
15. What is the meaning of localized interference structures and when do they appear?
16. How can white-light interference patterns be generated with a Michelson interferometer?
17. Give examples for interferometers with division of amplitudes and wavefronts respectively!
18. How interference structures can be generated with Fresnel’s mirror (lecture experiment)?

19. Explain the measurement of the complex degree of coherence with the Young interferometer!
20. Calculate the shift of the positions of interference maxima in a Young interferometer for a given phase of the degree of coherence!
21. Describe the realization of Haidinger fringes and Fizeau fringes with a Michelson interferometer!
22. What is the role of the compensation plate in the Michelson interferometer?
23. Are their compensation plates required for Mach-Zehnder or Sagnac interferometers too?
24. How can wavelengths and path differences be measured with a Michelson interferometer?
25. What is the meaning of a traceability measurement like it was performed out by Michelson with a cadmium lamp and the primary (secondary) standard?
26. Explain the generation of interference fringes for a Fabry-Perot interferometer!
27. What is the meaning of finesse for multiple-beam interferometers?
28. Derive the Airy-formulas of the reflected and transmitted intensities for multiple beam interferences given in the lecture!
29. Explain the instrumental function of a Fabry-Perot interferometer!
30. Which role do surface imperfections of mirrors play in the Fabry-Perot interferometer?
31. What is the meaning of effective finesse?
32. How is the free spectral range of a Fabry-Perot interferometer defined? Is there a difference with regard to the grating interferometer?