1. **Identification of documents\banknotes security elements.**

Objective: to obtain knowledge about basic means of preventing documents\banknotes from counterfeiting and forgery; to get to know contemporary document authenticity evaluation techniques generally used in document security technologies; to learn to identify banknotes\documents.

2. **Control of submicron elements by the optical analyser NIKON – S.**

Objective: to observe linear and stepper dimensions of submicron elements in passing light. Measured values range from 0.5 to 190 μm.

3. **Measurement of parameters of dielectric films by laser ellipsometer.**

Objective: to obtain understanding about basic principles of ellipsometry as well as measured quantities and to measure the optical parameters of dielectric films using the laser ellipsometer Gaertner L115.

4. **Surface wetting angle measurement.**

Objective: to determine the wetting angle of a given sample after physical, chemical, mechanical, ion plasma etc. impact; to plot diagrams of surface wettability.

5. **Measurement of reflectance and transmittance coefficients using photometer FO – 1.**

Objective: to gain knowledge about basic quantities describing photometric properties of materials; to measure coefficients of reflectance or transmittance of given samples for different wavelengths of light using photometer FO – 1.

6. **Infrared (IR) spectroscopy.**

Objective: to obtain knowledge about infrared (IR) spectroscopy method; to learn about spectrophotometer SPECORD 75, used for spectra recording; to identify the polymer mixtures by infrared spectroscopy technique.

7. **Measurement of colours by spectrophotometry method.**

Objective: to gain knowledge about basic quantities describing photometric properties and colour of materials; to measure reflectance coefficient of given samples for different wavelengths of light by photometer FO – 1; to calculate the main characteristics of sample colour.

8. **Atomic absorption spectral analysis.**

Objective: to learn about the major principles of atomic absorption spectral analysis and measurable quantities; to measure the concentration of copper in solution using atomic absorption spectrometer AAS-M403 Perkin Elmer.

9. **The formation of dielectric coating (SiO_2) by electron beam in vacuum.**

Objective: to gain knowledge about the formation technique of coatings (SiO_2) in vacuum by electron beam; to form SiO_2 dielectric coatings of various thicknesses on Si substrates using an electron gun.

10. **Investigation of ceramics employing X-ray photoelectron and Auger electron spectroscopies**

Objective: to familiarise with the methods of X-ray photoelectron spectroscopy and Auger electron spectroscopy; to investigate surface of the ceramic sample using XSAM800 Kratos Analytical X-ray photoelectron spectrometer.

11. **Laser interference lithography**

Objective: to familiarise with fabrication technology of periodical structures, namely laser interference lithography; to fabricate periodical structures in photoresist; to estimate the period of fabricated diffraction grating and orientation of gratings in respect to each other; to measure linear dimensions and quality of fabricated structures employing optical microscope.

12. **Investigation of semiconductor laser**

Objective: to familiarise with optical electronics semiconductor devices, light diode, semiconductor laser, photodiode; to investigate current-voltage and luxampere characteristics of semiconductor laser; to estimate dependence of efficiency on power used by laser; to evaluate forbidden gap width and external quantum efficiency of semiconductor.

13. **Investigation of periodical structures employing optical methods**

Objective: to familiarise with investigation of periodical structures employing optical methods; to evaluate diffraction efficiency of periodical structures; to estimate their geometrical dimensions employing optical microscope.

14. **Ultraviolet and visible light spectroscopy**

Objective: to familiarise with method of ultraviolet and visible light spectroscopy; to investigate optical characteristics of thin semiconductor films.

15. **Electrical measurements of resistance of semiconductors and conductors**

Objective: to familiarise with mechanisms of electrical conductivity of semiconductors and conductors; to perform and analyse temperature influence on resistance of semiconductors and metals; to evaluate forbidden gap width of semiconductor.

16. **Scanning electron microscopy (SEM) and energy dispersive X-ray spectrometry (EDX/EDS)**

Objective: to familiarise with methods of scanning electron microscopy and energy dispersive X-ray spectrometry; to perform SEM measurements employing different modes and learn to analyse obtained images; to perform EDX measurements and learn to evaluate the composition of investigated sample.

17. **Measurements of ionic conductivity of ceramic materials employing impedance spectroscopy method**

Objective: to familiarise with mechanisms of ionic conduction in ceramic materials; to perform measurements of ionic conduction dependence on temperature for these materials; to estimate activation energy of ionic conduction.

18. **X-ray fluorescence analysis**

Objective: to familiarise with methodology of X-ray fluorescence analysis; to estimate unknown elements in investigated sample (qualitative analysis) and relative concentration of every element in the sample (quantitative analysis).

19. **Quantitative evaluation of the surface free energy of solid state materials**

Objective: to evaluate the critical surface tension of the surface of solid state body using contact angle goniometer and four different liquids; to evaluate surface free energy using Owens and Wendt graphs.

20. **Formation of thin film structure topology using contact photolithography**

Objective: to form and characterise a single layer topology on a Si substrate using contact photolithography.

21. **Surface characterization using atomic force microscope**

Objective: to learn to characterise the surface of a sample using atomic force microscope (AFM); to quantitatively evaluate surface morphology and other properties of the sample.

22. **Conductometric analysis**

Objective: to learn to find and evaluate the conductivity of various material solutions; to familiarise with the means and techniques for measurement of specific electric conductivity.

23. **Investigation of polarising laser attenuator**

Objective: to familiarise with the tendencies of polarised optics and its capabilities to use polarising elements for the control of the intensity of a laser beam.

24. **Measurement of the Brewster angle using white polarised light**

Objective: to measure the Brewster angle of dielectric materials of different refractive indexes using a randomly chosen wavelength within the visible spectrum and a motorised setup for white polarised light measurements.

25. **Micro-machining of materials using femtosecond laser pulses**

Objective: to determine the threshold of laser effect for materials; to micro-machine surfaces using femtosecond laser Pharos and setup for microfabrication FemtoLAB.

26. **Pump-probe spectroscopy**

Objective: to investigate material absorption kinetics using pump-probe spectrometer Harpia and femtosecond laser Pharos.

27. **Formation of ceramic layers using plasma spray method**

Objective: to familiarise with the method of the plasma spray in vacuum; to fabricate a ceramic layer.