L3: Semiconductor laser

Exercise realization

1. Measurement of laser intensity in respect to temperature and supply current
2. Spectrometer calibration using Ar, Kr and Ne spectral lamps
3. Registration of laser spectrum at various temperatures and supply currents

Requirements for entrancement oral test

1. **Principles of laser physics:**
    a. Light – matter interaction, absorption, spontaneous and stimulated emission. Einstein coefficients,
    b. General conditions for laser action,
    c. General principles of laser construction,
    d. Laser resonator, transversal and longitudal modes

2. **Principles of semiconductor lasers:**
    a. Intrinsic and doped semiconductors, electron – hole generation and recombination, carriers scattering and energy distribution, principles of current conductivity,
    b. Physics of pn junction, potential distribution and barrier, forward and reverse bias and currents, current – voltage characteristic
    c. Principles of light detection with photodiodes
    d. Spontaneous and stimulated electron – hole recombination,
    e. Light Emitting Diodes
    f. Semiconductor lasers
    g. Basis of semiconductor laser construction

3. **Spectrometers**
    a. Spectrograph construction
    b. Principles of atomic optics: hydrogen atom and its spectra, noble gas atoms

Literature:

1. Wolfgang Demtröder, : *Laser Spectroscopy, Vol. 1: Basic Principles*
2. Charles Kittel, *Introduction to Solid State Physics*
3. R. Bube: *Photoconductivity in solids*
4. F.J. Blatt: *Physics of Electronic Conduction in Solids*
5. T. S. Moss: *Optical properties of semiconductors*
6. Micheal P. Marder: *Condensed Matter Physics*