Fundamentals of lasers

2019.

1. Rate equation modelling of lasers
- Einstein coefficients of absorption and emission
- Lines shape function
- Absorption and stimulated emission cross-section
- Optical amplification
- 3- and 4-level laser schemes

2. Laser resonators
- Matrix analysis of laser resonators
- Wave-optics description of resonators
- Gaussian beams
- Longitudinal and transverse mode selection

3. Gas-discharge and dye lasers
- He-Ne laser
- CO_2 laser
- Excimer lasers
- Dye lasers

4. Solid-state, fiber and semiconductor lasers
- Q-switching
- Ruby laser
- Neodymium lasers
- Fiber lasers
- Semiconductor lasers

5. Ultrashort pulse lasers
- Time-bandwidth product
- Mode-locking
- Dispersion compensation
- Ti:sapphire laser
- Temporal characterisation of ultrashort laser pulses

Suggested reading:
1. A.E. Siegman: Lasers (University Science Books, Sausalito, California, 1986).
2. J. T. Verdeyen: Laser electronics (Englewood Cliffs, New York, 1989).
3. J-C. Diels, W. Rudolph: Ultrashort laser pulse phenomena (2nd ed., Academic Press, 2006)