

## Electrodynamics 2 exam topics

Written sources are listed after each topic; abbreviations are resolved at the end.

1. Potential theory I. Laplace equation in rectangular domains. Spherical coordinates.  
JCE 2.8-2.9 and 3.1; ELN 3.3-3.4
2. Potential theory II. Laplace equation with azimuthal symmetry. Edge effect.  
JCE 3.2-3.4; ELN 3.5
3. Potential theory III. Spherical harmonics and their addition theorem. Multipole expansion.  
JCE 3.5-3.6; ELN 3.5, 3.7
4. Surface effects in conductors. Effective surface current density, power loss.  
JCE 8.1-8.2
5. General theory of wave guides. TEM, TE and TM modes in wave guides, Energy density and current, phase and group velocities.  
JCE 8.3-8.4 and 8.5 up to eqn. (8.54); ELN 9.5.1
6. Resonant cavities. Quality factor, Lorentz resonance curve.  
JCE 8.7-8.8; ELN 9.5.2
7. Electromagnetic waves in matter, dispersion, plasma frequency, microscopic model of polarisation.  
JCE 7.5-7.6; ELN 9.3 main part
8. Kramers-Kronig relation. Absorption and conductivity, Drude model.  
JCE 7.10; ELN 9.3.1-9.3.2
9. Radiation of localized oscillating sources. Multipole expansion of radiation.  
JCE 9.1-9.3; ELN 10.2
10. Scattering of electromagnetic waves on inhomogeneities, density fluctuations. Critical opalescence.  
JCE 10.1-10.2; ELN 12.1-2
11. Electromagnetic field of a moving charge. Lienard-Wiechert potentials and field strength, total radiated power.  
JCE 14.1-14.2; ELN 11.1-3 and 14.5
12. Radiation field of accelerated charge. Angular distribution. Ultrarelativistic case. Frequency spectrum of radiation.  
JCE 14.3 and 14.5; ELN 11.4-5
13. Cherenkov radiation, Frank-Tamm formula. Transition radiation.  
JCE 13.4 and 13.7; ELN 13.1-2; CTN
14. Radiation backreaction, the Abraham-Lorentz force.  
JCE 16.1-3, 16.7-8.

Course web page: [http://physics.bme.hu/BMETE15AF48\\_kov?language=en](http://physics.bme.hu/BMETE15AF48_kov?language=en)

Recommended reading:

- Electrodynamics 2 lecture notes (English).
- Electronic lecture notes (in Hungarian), abbreviated as ELN above; available from webpage.
- David J. Griffiths: Introduction to Electrodynamics (Pearson);
- John D. Jackson: Classical Electrodynamics (Wiley), abbreviated as JCE above;
- Supplementary notes for Cherenkov and transition radiation (in Hungarian), abbreviated as CTN above; available from webpage.