

## **EMOe - oral examination**

### **List of questions**

1. Electric charge. Quantization of electric charge. Conservation of charge. Charge density. Coulomb's law.
  2. Electric field. Scalar and vector field description. Field intensity. Potential energy and Potential.
  3. Gauss law. Solution of typical problems.
  4. Electric conductors and non-conductors. Dielectrics. Polarization. Permittivity and susceptibility.
  5. Capacitance. Capacitors in parallel and in series. Energy of electric field.
  6. Stationary current. Resistivity and conductivity. Ohm's law.
  7. Electric circuits. Kirchhoff's circuit laws. Work, energy and power.
  8. Thermoelectric effects.
  9. Magnetic field. Flux density. Lorenz force. Charged particle motion.
  10. Magnetic force on a wire. Magnetic dipole moment. Torque on a current loop.
  11. Ampere's law. Solution of typical problems.
  12. Biot-Savart law. Solution of typical problems.
  13. Magnetic flux. Faraday's law. Lenz's law. Induced electric field.
  14. Self-induction and mutual induction. Energy of magnetic field. Alternating current.
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1. Magnetism of matter. Magnetic field intensity.
  2. Para-, Dia-, and Ferromagnetism.
  3. Electromagnetic field. Maxwell's equations.
  4. Electromagnetic waves. Energy transport. Poynting vector. Intensity. Wave spectra.
  5. Geometrical optics. Reflection and refraction. Snell's law. Wave interactions with matter.
  6. Planar and spherical mirrors. Thin lenses. Fibre optics. Optical instruments.
  7. Wave of light. Reflection and refraction of light wave. Interference of light. Coherence. Diffraction of light. Polarization of light.
  8. Quantum nature of electromagnetic waves. Photons. Radiation laws. Principle of infrared imaging.
  9. Introduction to Quantum physics. Photos and particles. Momentum and energy. Photoelectric effect.
  10. Properties of atoms. Elementary particles. Bohr model. Wave nature of electrons. Wave-particle duality. Heisenberg's uncertainty principle.
  11. Time-independent Schrödinger's equation. Hydrogen atom. Emission spectra of hydrogen. Pauli exclusion principle. Periodic table of elements.
  12. Emission and absorption. Spontaneous and stimulated emission. Laser principle.
  13. Solid state of matter. Structure. Bonding in solids.
  14. Electronic band structure. Conductivity. Semiconductors and doping.