

General subjects for first probe Bachelor degree exam

Electrical engineering and computers program

- Simple AC circuits with resistors, coils, capacitors. Impedance, reactance, resistance in AC circuits. Impedance triangle
- RLC circuits in AC. The resonance phenomenon
- Powers in AC single-phase circuits. Power triangle. Power factor. Improving the power factor
- Powers in AC three-phase circuits
- Electromagnetic induction law and applications
- The Skin effect; The skin depth; DC resistance vs High Frequency AC resistance; Applications
- Sensors: Classifications; Principles of sensing; Examples
- Temperature sensors – effects used for temperature sensing (e.g., Seebeck effect, resistivity variation with temperature – RTDs, p-n junction and bandgap temperature sensors)
- Interfacing circuits used for specific input signals, provided by sensors, as voltage, current, charge, resistance (i.e., signal conditioning circuits, I-V, C-V, Q-V circuits)
- Electrical installation characteristics, activity, site topology, layout latitude, service reliability, maintainability, installation flexibility, power demand, load distribution, power interruption sensitivity, disturbance sensitivity, disturbance capability of circuits
- Electric shock, protection against electric shock, direct and indirect contact
- The basic functions of LV switchgear, electrical protection, isolation, switchgear control
- Circuit-breaker, standards and description, fundamental characteristics of a circuitbreaker, other characteristics of a circuit-breaker, selection of a circuit-breaker, coordination between circuit-breakers, discrimination MV/LV in a consumer's substation
- Voltage surge, the four voltage surge types, main characteristics of voltage surges, different propagation modes
- Overvoltage protection devices, primary protection devices (protection of installations, against lightning), secondary protection devices (protection of internal, installations against lightning)
- Transformers: tests, losses, efficiency and parallel operation
- Rotating electrical machines: construction and mechanical parameters
- Induction machine: operating modes, power losses diagrams, mechanical characteristic
- Synchronous generators: phasors diagrams, equivalent circuits
- Synchronous motors: torque equation and mechanical characteristic
- DC machines: speed regulation for motors and voltage regulation for generators
- Reluctance motors: types, construction particularities, control features
- Synchronous compensator vs. STATCOM: comparison and particular characteristics
- Electrical motors used in commercial EVs: comparison based on the six significant criteria
- Generators for wind systems: electrical diagrams

Bibliography:

- Schneider Electrical Installation Guide, 2007
- Scutaru Gh., and all, Electrical circuits, 2004
- Volmer M., Applied Physics for Engineering, Transilvania University Publishing House, 2007
- Volmer M, Electromagnetic field theory - Lecture notes and applications, Transilvania University Publishing House, 2022
- Volmer M., Sensors and microsensors – Theoretical and practical notes, Transilvania University Publishing House 2022
- Stephen J. Chapman, Electric machinery fundamentals, 2005
- Theodore Wildi, Electrical, machines, drives and power systems, 2006
- I7 / 2011 Norm