4.2.3. Electrostatics

- **Ass.:** 1) $\frac{\partial}{\partial t} = 0$
  2) $\sigma = 0$: only non-conducting regions

- Electrostatic Problem follows from (1) or (8):

$$(9) \begin{cases} (1)_F & \operatorname{curl} E = 0 \quad \overset{\Omega}{\underset{\text{simply connected}}{\Longrightarrow}} \quad E = -\nabla\varphi \\ (1)_{eG} & \operatorname{div} D = \varrho \\ (2)_{DE} & D = \varepsilon E = -\varepsilon\nabla\varphi \end{cases}$$

that leads to

$$(10) \quad -\operatorname{div}(\varepsilon\nabla\varphi) = \varrho \quad \text{in } \Omega$$

+BC: e.g. given surface charges ϱ_s:

$$\varepsilon\nabla\varphi\cdot n = -D\cdot n = -\varrho_s \quad \text{on } \Gamma_s$$

or PEC: $E \times n = -\nabla\varphi \times n = 0$

i.e. $\varphi = U_i := \int_{\Gamma_i} E\cdot n \, ds = \text{const}$

applied voltages on $\Gamma_{PEC,i}$