RF Reflectometry of Single-Electron Circuits

Part A: Lumped element model of a co-axial transmission line (2.0 points)

A.1 (0.2 pt)
$v =$

A.2 (0.2 pt)
$E(r) =$

A.3 (0.3 pt)
$C_x =$

A.4 (0.3 pt)
$L_x =$

A.5 (1.0 pt)
i.

ii. $b/a =$

Part B: Hypothetical transmission line with return along a grounded plane (1.0 points)

B.1 (1.0 pt)
$Z_0 =$

Part C: Basics of RF reflectometry (1.2 points)

C.1 (1.0 pt)
$\Gamma =$

C.2 (0.2 pt)

Part D: The single electron transistor (points 3.3)

D.1 (1.5 pt)
i. $\varphi_n =$

ii. $\Delta E_n =$

D.2 (0.5 pt)
$E_c =$

D.3 (0.5 pt)

D.4 (0.8 pt)
i. $\tau =$
ii.

Part E: RF reflectometry to read out SET state (1.0 points)

E.1 (0.2 pt)
$\Delta\Gamma =$

E.2 (0.8 pt)
$L_0 =$
$\Delta\Gamma =$

Part F: Charge sensing with a single lead quantum dot (1.5 points)

F.1 (1.0 pt)
$\omega_{\mathrm{rf}} =$
$Z_C =$

F.2 (0.5 pt)