EE 483/583 Antennas for Wireless Communications
Quiz #4 (Spring 2026)

Name KEY

Instructions: Open book & notes. Place answers in indicated spaces and show all work for credit. Assume $c = 2.998\times10^8$ m/s.

A 1.6 m long dipole, oriented along and centered on the z-axis in free space, is made using a 2 in (5.08 cm) thick aluminum pipe. It is to be driven by a voltage source over a frequency range of 80 to 120 MHz. To prepare to simulate this antenna using NEC-2:

a) Find the shortest and longest wavelengths (cm) of interest.

$$\lambda_{short} = c/f_{high} = 2.998\cdot10^8/120\cdot10^6 = 2.498333 \text{ m} \Rightarrow \boldsymbol{\lambda_{short} = 249.833 \text{ cm}}$$

$$\lambda_{long} = c/f_{low} = 2.998\cdot10^8/80\cdot10^6 = 3.7475 \text{ m} \Rightarrow \boldsymbol{\lambda_{long} = 374.75 \text{ cm}}$$

λ_{short} = **249.833 cm** λ_{long} = **374.75 cm**

b) Find wire radius a (mm). $2a = 5.08$ cm $= 50.8$ mm a = **25.4 mm**

c) For the worst-case scenario, is the wire considered to be 'thin'? **[Yes]** / No (circle correct answer)

To be thin, check if $2\pi a/\lambda_{short} = \pi d/\lambda_{short} << 1$:

$\pi d/\lambda_{short} = \pi(5.08)/249.833 = 0.06388 << 1 \Rightarrow$ **Yes**, it is thin.

Quantitative justification for answer **$\pi d/\lambda_{short} = 0.06388 << 1$**

d) Find the shortest allowable segment length Δ_{min} (cm) and corresponding number of segments N_{min} for the model for the frequency range specified. **Constraints**- Dipole is to be center-fed, *avoid* using the extended kernel (minimize processing time), and NEC-2 model must use an integer number to segments.

First, we need $\lambda_{long}/1000 < \Delta_{min}$, $\Delta_{min} > 374.75/1000 \Rightarrow \Delta_{min} > 0.37475$ cm.

To avoid the EK command, we need

$$\Delta_{min}/a \geq 8 \Rightarrow \Delta_{min} \geq 8a = 8\,(2.54 \text{ cm}) \Rightarrow \boldsymbol{\Delta_{min} \geq 20.32 \text{ cm}}!$$

Next, the dipole must have an *odd integer* number of segments to be center-fed.

$\ell/\Delta_{min} = 160 \text{ cm}/20.32 \text{ cm} = 7.87 \Rightarrow$ The next *lower* **odd** integer is **$N_{min} = 7$**.

Based on this, we calculate $\Delta_{min} = 160$ cm/7 $\Rightarrow$ **$\Delta_{min} = 22.8571$ cm**

Δ_{min} = **22.8571 cm** N_{min} = **7**

e) Write the applicable geometry command to model the dipole based on your answer to **part d)**.

Geometry command: **GW 1 7 0.0 0.0 -0.8 0.0 0.0 0.8 0.0254**