

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

Homework 13 (optional extra credit)

Tuesday, April 28, 2026

- 1) 6.3 First, find the progressive phase shift β (deg). Hint: Start with forms similar to equations (6-2) & (6-7) for the AF, then use Euler's Identity to simplify.
- 2) For the array in 6.3, find: a) the location(s) of the maxima θ_m , b) power radiated by the array P_{rad} , c) a function for the directivity $D(\theta)$ as well as D_{max} (unitless & dBi), and d) half-power points θ_h as well as half-power beamwidth (HPBW) in degrees. These can be found analytically or numerically using MATLAB, MathCad, ... Lastly, plot the normalized directivity polar radiation pattern (in dB) in the x - z plane. Use a 0 to -40 dB scale with $\theta = 0$ at the top.
- 3) 6.9 For part d), find estimated maximum directivity and then calculate exact maximum directivity D_{max} (unitless & dBi) using Matlab or MathCad.
- 4) 6.12 For part a), also make a rectangular plot of $|AF(\theta)|$ versus θ . In part e), can verify using Matlab or MathCad.
- 5) 6.26 Use 18 isotropic elements.
- 6) **EE 483 only:** 6.18dc Do part d) first, also finding β (rad & deg). For part c), also make a rectangular plot of $|AF(\theta)|$ versus θ , find $|AF|_{\text{max}}$ & $|AF|_{\text{sidelobe,max}}$, and compute both estimated & exact D_{max} (unitless & dBi).
- 7) **EE 583 only:** 6.18ab For part a), also find β (rad & deg). For part b), also make a rectangular plot of $|AF(\theta)|$ versus θ , find $|AF|_{\text{max}}$ & $|AF|_{\text{sidelobe,max}}$, and compute both estimated & exact D_{max} (unitless & dBi). [Hints: Maximum spacing is reached when the AF climbs up the closest grating lobe to a value equal to the largest sidelobe. I found a solution by iteratively creating rectangular plots of $|AF(\theta)|$ for different spacings, i.e., started at $d = 0.5\lambda$ and decreased.]

Notes:

- If done, this extra credit opportunity will replace your lowest HW *or* quiz grade (as best advantages your overall grade).
- There will be at least one question dealing with this material on the final.

Due Tuesday, May 5, 2026 by 2 pm at my office or EECS mail box.