

# CURRENT PLACEHOLDER, SOME SUMMARY HAS EMOJI PLEASE HELP REMOVING THEM

Category	# Ques-	Description	Typical Questions
Side Ques-tions (Conceptual Theory)	13	Key oral theory concepts: phase center, grating lobes, mutual coupling, miniaturization, and CEM methods.	- What is the phase center? - What are grating lobes? - What's the Wheeler-Chu limit? - What's the difference between DE and IE methods? - Why is miniaturizing antennas difficult? - What is mutual coupling?
Antenna Fundamentals ( $\lambda$ , f, Friis, Gain)	6	Core topics: frequency-wavelength, Friis, gain, effective area.	- What is the wavelength at 3GHz? - Derive and explain the Friis equation. - How can $P_r > P_t$ be explained? - Can aperture efficiency exceed 1?
Scattering & Electromagnetic Theory	5	Modeling materials in EM fields, relation of scattered and total fields.	- What happens when a scatterer is a PEC or dielectric? - Solve $E_{tot} = E_{inc} + E_{scat}$ . - Describe the role of induced currents.
Slot and Microstrip Antennas	5	Radiation from slots, patch resonance, equivalence use.	- Explain how a microstrip antenna works. - What resonates and in which direction? - Use equivalence theorem to analyze a slot.
Dipole and PEC Image Problems	4	Image theory and PECs affecting dipole fields.	- Draw the image of a dipole over PEC. - What is the far field of a dipole near PEC? - What height gives optimal directivity?

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<b>Far Field Radiation &amp; Antenna Patterns</b>	4	Calculate radiated E and H fields from simple sources.	- Use elementary dipole formulas to find far field. - What is the pattern in the $\phi = \pi/2$ plane? - Derive $F(r)$ for a radiating dipole.	
<b>Nulls and Directivity</b>	4	Placing nulls, shaping beam with geometry and phase.	- Find smallest $h$ to get a null at $\theta = 60^\circ$ . - How can antenna placement create nulls? - Optimize $h$ for main lobe targeting.	
<b>Equivalence Theorems &amp; Boundary Conditions</b>	3	Use of surface equivalence and physical meaning of boundary conditions.	- What does the equivalence theorem state? - Explain surface currents at PEC. - Why must E and H fields be continuous?	
<b>Uniform Linear Array (ULA) Theory</b>	2	Element count vs pattern shaping, gain, and aperture.	- What happens to main lobe as $N \rightarrow \infty$ ? - How do grating lobes appear? - Prove scaling laws for gain and aperture.	